

TIME DOMAIN ELECTROMAGNETIC SOUNDINGS  
NEAR WAIKOLOA VILLAGE, HAWAII

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## Table of Contents

	<u>Page</u>
1.0 EXECUTIVE SUMMARY.....	1
2.0 INTRODUCTION.....	2
3.0 LOGISTICS AND DATA ACQUISITION.....	4
4.0 DATA PROCESSING AND INTERPRETATION.....	5
4.1 GENERAL.....	5
4.2 CHARACTERISTICS OF GEOELECTRIC SECTION AT WAIKOLOA.....	5
5.0 RESULTS.....	9
6.0 CONCLUSIONS AND RECOMMENDATIONS.....	11
7.0 REFERENCES.....	12

### Appendices

A - Brief Description of TDEM

B - Equipment Specifications

## 1.0 EXECUTIVE SUMMARY

Time domain electromagnetic (TDEM) soundings were used to assist in the ground water evaluation of approximately 50 square miles of property near Waikoloa Village.

The results of the TDEM survey show:

1. Depth to saline water is highly variable over the study area.
2. Three areas were identified which show high potential for significant fresh water reserves at relatively low elevation. These areas include the area where wells are currently being pumped and drilled (near soundings 2, 30, 1 and 5), areas near soundings 33, 34, and 31, and near soundings 6, 23 and 24.
3. Over most of the study area at elevations above 1,800 ft the depth to saline water was not detectable within the limits of exploration of the TDEM system (approximately 3,600 ft). Thus, large quantities of fresh water are expected to exist at these elevations, but drilling depth to these resources also would be large.

## 2.0 INTRODUCTION

This report contains the results of time domain electromagnetic (TDEM) surveys accomplished near Waikoloa Village on the Island of Hawaii. The TDEM survey was accomplished during the time period from November 30, 1988 to December 9, 1988.

The purpose of the TDEM survey was to assist in the ground water resource evaluation of approximately 50 square miles of land. A site location map showing the approximate boundaries of the study area is given in Figure 2-1.

The specific exploration objectives for the geophysical survey can be understood from the schematic hydrogeologic cross section shown in Figure 2-2. For much of the island of Hawaii, ground water is contained in the basal mode, i.e., resting nearly at sea level. This is mainly due to the fact that the volcanic rocks which comprise the island allow rainwater to percolate with little impedance directly downward through the island mass. The fresh water is assumed to float upon salt water which has encroached from the ocean. Lateral flow of fresh water towards the ocean causes the fresh water lens to be thinner towards the ocean. The Ghyben-Herzberg principle states that under conditions of static equilibrium, for every foot of fresh water above sea level, 40 ft of fresh water below sea level will exist.

The transition from fresh water to sea water is generally quite sharp. For example, studies at Laura Island at the western edge of Majuro Atoll in the Republic of the Marshall Islands indicated a transition zone thickness (vertical distance between the 300 to 18,000 mg/l isochlor) of 5 to 7 meters (Kauahikaua, 1987). Further inland, dikes of impermeable rocks can provide a barrier to ground water flow, resulting in high-level ground water, and discontinuities in hydraulic gradients.

The main objective of the geophysical survey was to determine elevation and thickness of the lens of fresh water floating on saline water. Because the electrical resistivity of formations is highly dependent upon the salinity of ground water, an electrical surface geophysical technique was chosen to map the depth to salt water.

Previous geophysical surveys by Zhody (1969) and Kauahikaua (1983) on the Island of Hawaii using direct-current Schlumberger soundings, show large resistivity contrasts between volcanic rocks saturated with fresh water and saline water. The specific electromagnetic technique selected was the TDEM method because of its better lateral and vertical resolution, compared to other electrical and electromagnetic techniques.

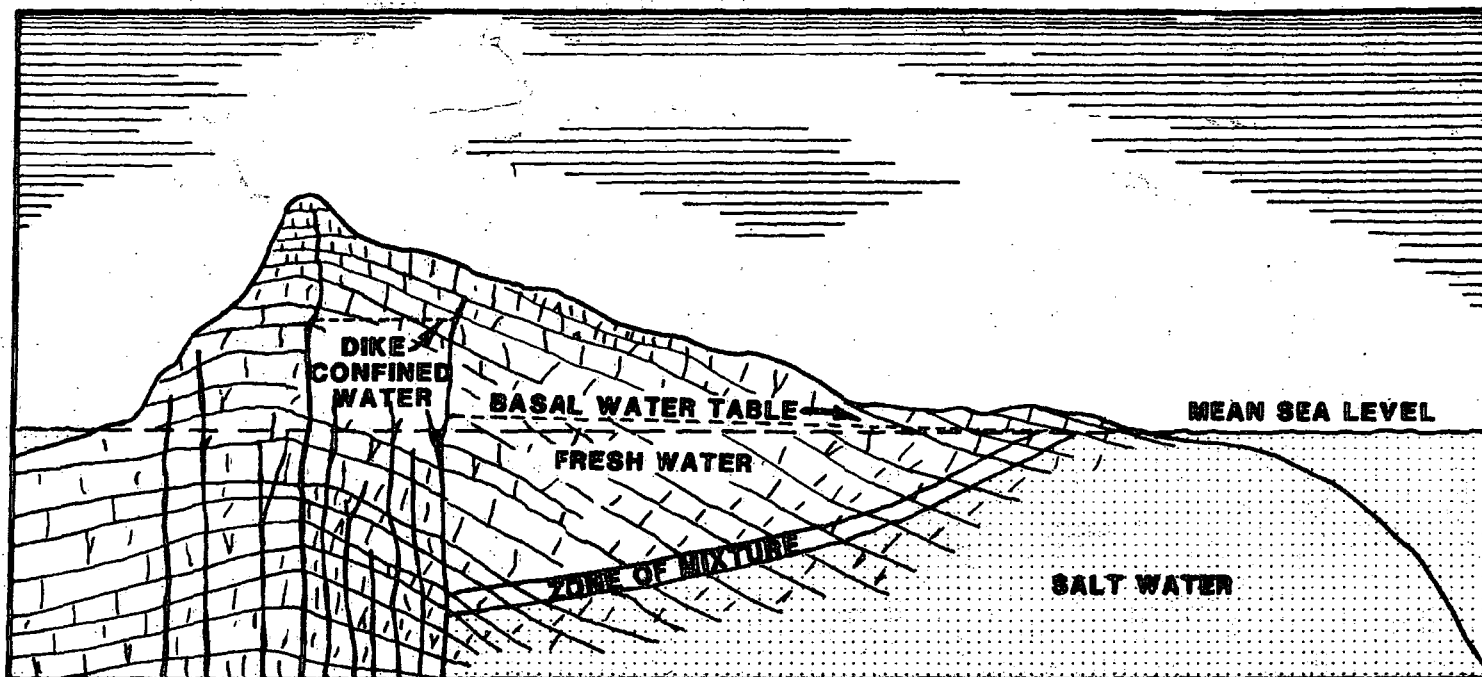
A brief description of the fundamentals of TDEM is given in Appendix A.

### 3.0 LOGISTICS AND DATA ACQUISITION

For the TDEM soundings, measurements were made in the center of square non-grounded transmitter loops. The size of the transmitter loops varied from 125 ft by 125 ft to 1,500 ft by 1,500 ft, depending upon the required exploration depth. The map showing the locations of the TDEM soundings is given in Figure 2-1. The transient system used for the survey was the Geonics EM-37, the specifications of which are given in Appendix B. The crew consisted of four personnel, one project geophysicist, one staff geophysicist, and two local field helpers. Two 4-wheel drive jeeps were used to transport the equipment.

Because the transient equipment is not easily portable, the sounding locations were positioned along highways, jeep roads and trails. Fill-in soundings on the last day of the survey were accomplished using helicopter support. A daily log of field activities is given in Table 3-1.

The data acquired at each station was stored in the field on a solid state data logger and subsequently dumped to a Compaq 386/20 microcomputer each evening for processing. The data acquired at each station usually consisted of measurements at several different receiver gain settings, and transmitter base frequencies in order to assure data quality and obtain data over the largest time range possible. Data quality was generally very good. Only one sounding (001W018N), was affected by powerline interference to the point that it was rejected.



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SCHEMATIC HYDRO-GEOLOGIC  
CROSS SECTION

PROJECT NO.: 00000

FIGURE 2-2

Table 3-1. Daily Log of Activities

Date	Activity	Production - Loop Size
11/29/88	Mobilization from Denver, CO to Waikoloa Village, HI	
11/30/88	Field Work	Sounding 001W001N (500' x 500')
12/01/88	Field Work	<u>1000' x 1000'</u> 001W002N and 001W003N (1,000 ft offset)  <u>500' x 500'</u> 001W001N (repeat) 001W004N (500' offset from 001N)  <u>1000' x 1000'</u> 001W005N and 001W006N
12/02/88	Field Work	<u>1000' x 1000'</u> 001W007N, 001W008N (500' offset from 007N) and 001W009N  <u>500' x 500'</u> 001W010N  <u>125' x 125'</u> 001W011N
12/03/88	Field Work	<u>1000' x 1000'</u> 001W012N, 001W013N, 001W014N and 001W015N
12/04/88	Field Work	<u>1000' x 1000'</u> 001W016N, 001W017N, 001W018N and 001W019N
12/05/88	Field Work	<u>1000' x 1000'</u> 001W020N  <u>1500' x 1500'</u> 001W021N and 001W022N
12/06/88	Field Work	<u>1000' x 1000'</u> 001W023N and 001W024N  <u>1500' x 1500'</u> 001W025N and 001W026N



Table 3-1. Daily Log of Activities (Continued)

Date	Activity	Production - Loop Size
12/07/88	Field Work	<u>1000' x 1000'</u> 001W027N and 001W028N
		<u>500' x 500'</u> 001W029N
12/08/88	Field Work	<u>1000' x 1000'</u> 001W030N, 001W031N and 001W032N
12/09/88	Field Work (Helicopter Support)	<u>1000' x 1000'</u> 001W033N, 001W034N and 001W035N
12/10/88	Demobilization	
12/11/88	Demobilization	
Summary	10 Field Days	1 - 125' x 125' sounding 4 - 500' x 500' soundings 26 - 1000' x 1000' soundings 4 - 1500' x 1500' soundings

## 4.0 DATA PROCESSING AND INTERPRETATION

### 4.1 GENERAL

All data taken in the field were transformed into apparent resistivity and interpreted using an Automatic Ridge Regression Transient Inversion (ARRTI) routine on a Compaq 386/20. The results of the transient inversion from a typical station (1W11N) are shown on Figures 4-1 and 4-2. Figure 4-1 shows the experimentally measured apparent resistivity data superimposed upon the computed behavior (solid line) of subsurface resistivity layering that best matches the observed data. The resistivity layering of the best match is shown on the right. Figure 4-2 lists gate number, time, measured data, computed values and errors for each time gate, as well as overall RMS error. In this example, the layer with a resistivity of 2.87 ohm-m represents saline water.

Model parameters which are given as input to the inversion program include number of layers and initial values of resistivity. The program then adjusts these parameters in order to maximize the fit between the experimental data and the computed behavior of the model. The program does not change the number of layers, but allows all other parameters to float freely unless they are held fixed. For all calculations a one-dimensional (horizontally layered) model is assumed.

### 4.2 CHARACTERISTICS OF GEOELECTRIC SECTION AT WAIKOLOA

The normal hydrogeologic section at Waikoloa consists of a three-layer section, i.e., an upper unsaturated volcanic zone, a fresh water saturated volcanic zone, and a saline saturated volcanic zone. The transition zone between fresh and saline saturated volcanics can probably be neglected or combined with the saline saturated volcanics in most cases due to its relatively small thickness compared to the other layers.

In terms of geoelectric layers this hydrogeologic section is a two-layer section with values as shown in Table 4-1.

Table 4-1. Geoelectric Layers and Corresponding Hydrogeologic Units.

Geoelectric Unit	Hydrogeologic Unit
Highly Resistive (600 to 6,000 ohm-m)	Unsaturated volcanics fresh water saturated volcanics
Highly Conductive (2 to 10 ohm-m)	Transition zone saline saturated volcanics

In Figure 4-3 a suite of computed model curves for a two-layer section with a conductive basement layer is given. An explanation of the variables is also given on this figure. For a particular section, the horizontal axis is related to the time range of measurement, and the vertical axis is related to the measured apparent resistivity. The index of the curves is the ratio  $\rho_2 / \rho_1$ .

The important observations that can be made from this suite of curves are:

1. Where  $\rho_2 / \rho_1$  is 1/60 or less ( $\rho_1$  is more than 60 times  $\rho_2$ ) the descending branches of the curves are parallel over a large range of time ( $\tau_1 / h_1$ ).
2. In order to resolve  $\rho_2$  (for sections with  $\rho_2 / \rho_1 = 1/60$  or less) measurements must be made to values of  $\tau_1 / h_1$  in excess of 100, i.e., late enough in time for the curve to asymptotically approach  $\rho_2$ .

The apparent resistivity curves on Figure 4-3 are calculated for a broad time range of measurement. The typical time range of measurement for the TDEM survey at Waikoloa with the EM-37 is shown on the figure. This time range does not allow resolution of  $\rho_2$  for cases where  $\rho_2 / \rho_1 = 1/60$  or less, and measurement later in time would require a large additional effort (increasing transmitter loop size). Furthermore, it can be shown that variations in the value of  $\rho_2$  do not have a major influence on the accuracy of deriving  $h_1$  as long as  $\rho_2 / \rho_1 = 1/60$  or less.

It has been shown that depth to a conductive basement for the geoelectric section in the Waikoloa area for points on the right-hand descending branch of the apparent resistivity curve is given by (Kaufman and Keller, 1983):

$$H_{KM} = \frac{\rho_T^{4/9} \rho_B^{1/9} (\sqrt{2\pi t})^{10/9}}{3.36 r^{1/9}}$$

where  $H_{KM}$  is depth to basement in kilometers

$\rho_T$  is resistivity value at some point on the descending branch

$t$  is corresponding time of  $\rho_T$

$\rho_B$  is resistivity of basement, and

$r$  is transmitter loop radius in kilometers.

It can be seen from the above equation that errors in determining the basement resistivity (saline water) have only a slight effect on the accuracy of determining  $H$ . For example, a one hundred percent error in determining  $\rho_B$  results in only a seven percent error in determining  $H$ .

To illustrate this relation on data from the survey area, the apparent resistivity curve for 1W28N is given in Figure 4-4. In this figure the resistivity of the basement layer was held fixed at 2.8 ohm-m. In Figure 4-5 the resistivities of both layers and the thickness of the first layer were allowed to float in the inversion. The difference between the thickness of the first layer (depth to saline water) between these two models is less than four percent, while the resistivity of the basement layer has changed by nearly fifty percent.

In Figure 4-6 forward model curves for the two-layer case typical of the Waikoloa area are given. The parameter varied in these curves is  $h_1$ , or depth to saline water. For these calculations a 1,000 ft by 1,000 ft transmitter is used as the source, and the curves are shown over the typical time range of measurement of the EM-37. This figure illustrates that changes in depth to basement (saline water) results in large measureable changes in the apparent resistivity curves over the entire time range of measurement.

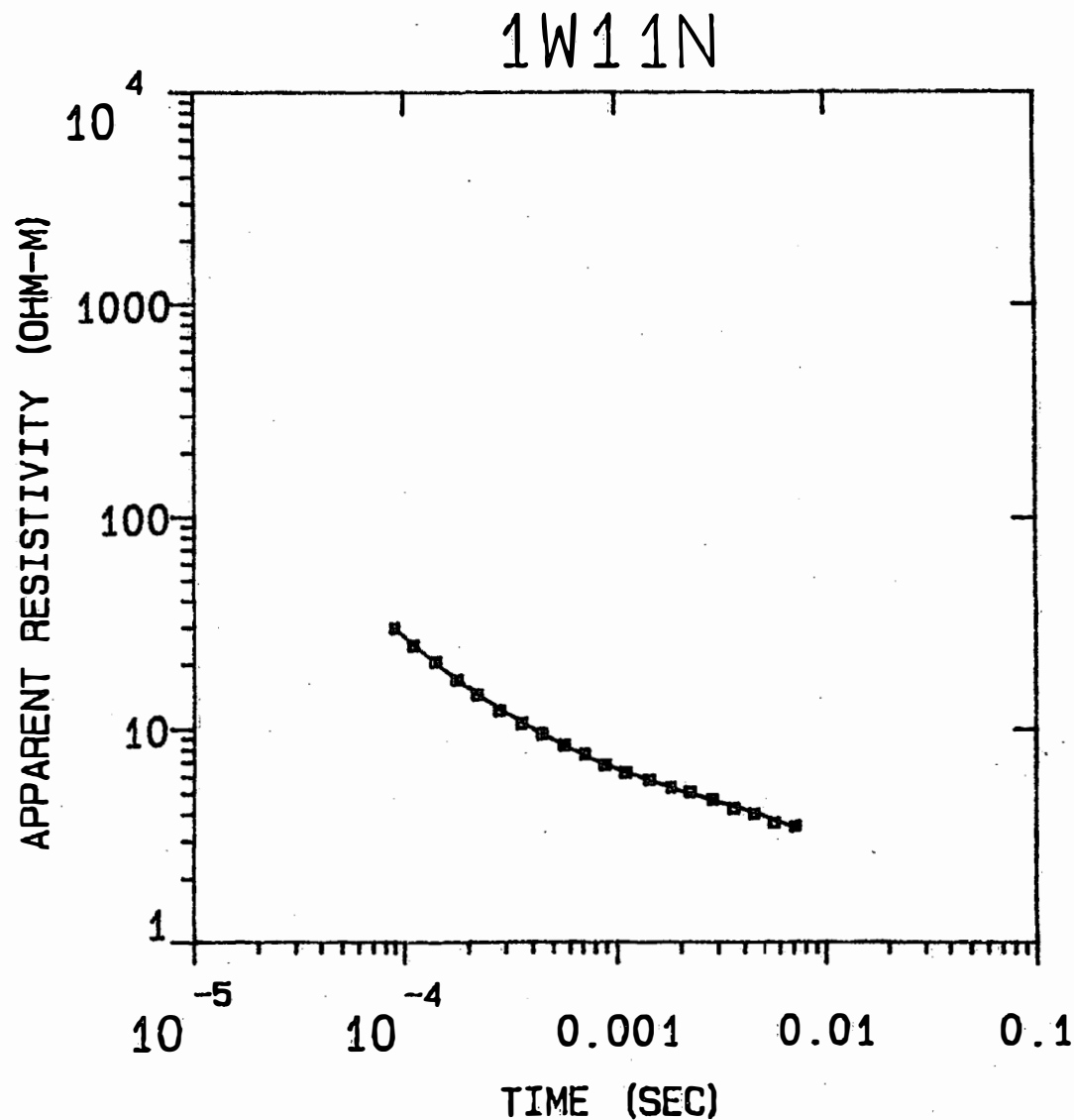
For the Waikoloa TDEM survey the value used for the resistivity of saline saturated volcanics was determined experimentally at sounding 1W11N (see Fig. 2-1). This sounding was located close to the ocean so that the depth to the saline saturated volcanics would be minimized. The value determined from this sounding for saline saturated volcanics is 2.8 ohm-m (Fig. 4-1).

The resistivity of the unsaturated volcanics and fresh water saturated volcanics was typically 600 to 6,000 ohm-m as determined from the inversion results. This resistivity range is consistent with Direct Current Resistivity measurements made by Zhody and Jackson (1969).

Thus, for the interpretation of the TDEM data, a fixed value of 2.8 ohm-m was used for the saline saturated volcanics (basement layer) and the other model parameters were allowed to float in the inversion. In all interpretations, the minimum number of layers required to fit the data was used. Typically, a good fit to the data was derived from a two-layer model. In some cases three layers were necessary to accurately fit the data. For soundings which did not display a steep descending branch in the apparent resistivity curve, the saline saturated volcanics are beyond the effective exploration depth.

TDEM soundings at higher elevations and in areas where the saline water was expected to be deep were read with larger transmitter loop sizes. In Figures 4-7 and 4-8 forward model calculations are given for 1,000 ft and 1,500 ft transmitter loops for the typical geoelectric section observed in the Waikoloa area. In both figures the thickness of the first layer is varied. The model curves have been terminated at the expected minimum detectable signal.

To determine depth to the conductive saline layer some data need to be collected on the right-descending branch. Figure 4-7 shows that at a depth of 1,200 m (about 3,600 ft), no data are expected to be observed on the descending branch. Similarly, from Figure 4-8 effective exploration depth with 1,500 ft by 1,500 ft transmitter loops is expected to be about 1,400 m (about 4,200 ft). Thus, for soundings for which no data were recorded on the right-descending branch, the saline water interface is expected to be at a minimum depth of 3,600 ft below the surface. Depth to saline water at these soundings is indicated by ND (not determined).



MODEL:

619.	
OHM-M	27.8 M

2.87
OHM-M

EXAMPLE OF  
INVERSION RESULTS

% ERROR: 1.83  
 CALIBRATION: 1  
 OFFSET: 19.1 M  
 RAMP: 35.0  
 INTERPEX: ARRTI

FIGURE 4-1

1W11N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
618.90	27.8	24.4	80.0	0.0	0.0
2.87		-3.5	-11.3		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.98E+01	3.00E+01	-0.506	
2	1.10E-04	2.46E+01	2.49E+01	-0.938	
3	1.40E-04	2.06E+01	2.03E+01	1.322	
4	1.77E-04	1.70E+01	1.70E+01	0.205	
5	2.20E-04	1.44E+01	1.45E+01	-0.719	
6	2.80E-04	1.22E+01	1.23E+01	-1.149	
7	3.55E-04	1.06E+01	1.07E+01	-0.871	
8	4.43E-04	9.49E+00	9.44E+00	0.527	
9	5.64E-04	8.40E+00	8.33E+00	0.768	
10	7.13E-04	7.64E+00	7.50E+00	1.846	
11	8.85E-04	6.81E+00	6.81E+00	-0.013	
12	1.10E-03	6.26E+00	6.26E+00	-0.327	
13	1.41E-03	5.79E+00	5.75E+00	0.696	
14	1.78E-03	5.35E+00	5.31E+00	0.800	
15	2.21E-03	5.08E+00	4.99E+00	1.807	
16	2.83E-03	4.67E+00	4.64E+00	0.638	
17	3.55E-03	4.26E+00	4.35E+00	-2.123	
18	4.43E-03	4.04E+00	4.08E+00	-1.031	
19	5.64E-03	3.67E+00	3.77E+00	-2.550	
20	7.13E-03	3.53E+00	3.47E+00	1.484	

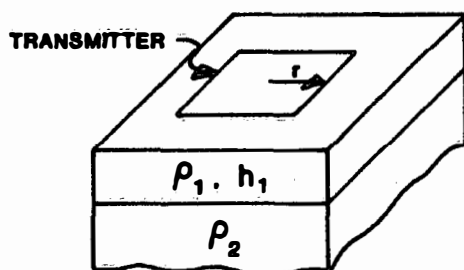
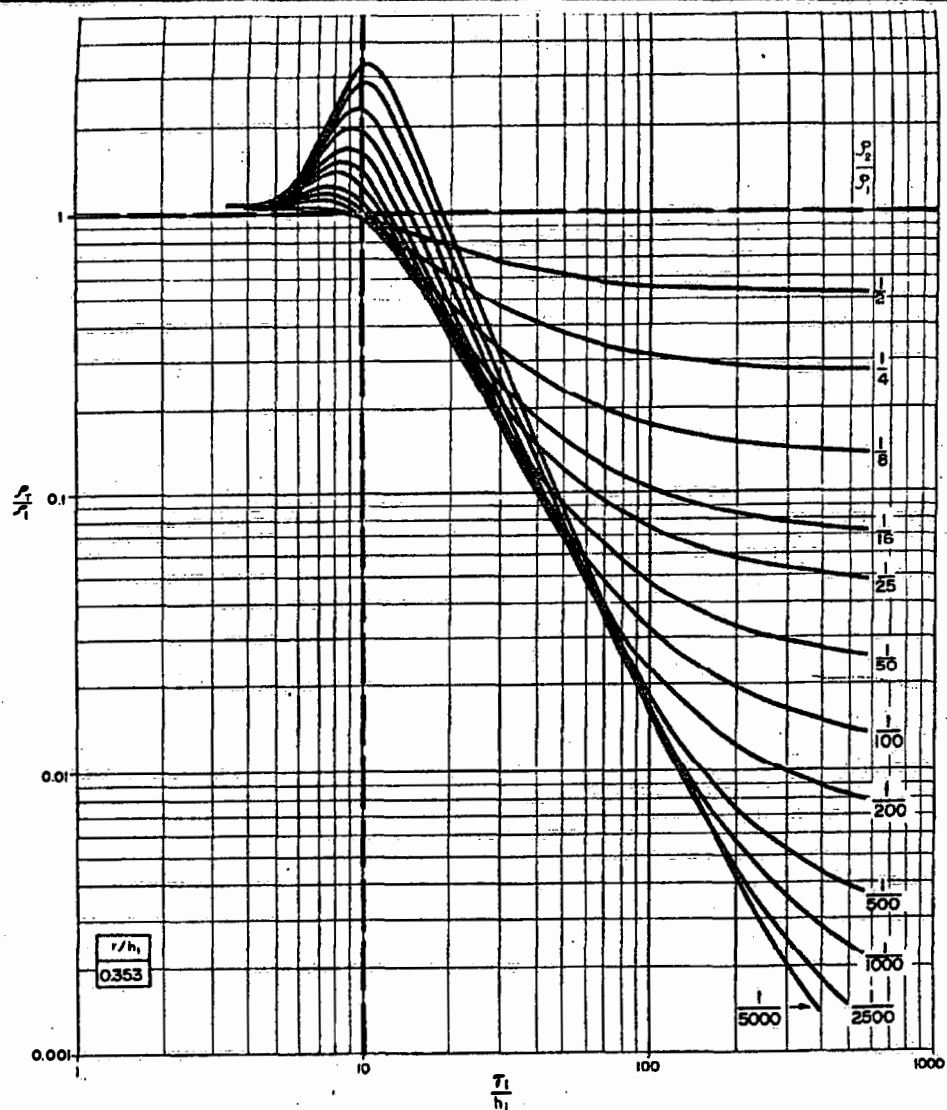
R: 19. X: 0. Y: 19. DL: 38. REQ: 21. CF: 1.0000  
 TDHZ ARRAY, 20 DATA POINTS, RAMP: 35.0 MICROSEC, DATA: 1W11N  
 WAIKOLOA  
 NEAR OCEAN  
 RMS LOG ERROR: 7.86E-03, ANTILOG YIELDS 1.8258 %  
 LATE TIME PARAMETERS

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PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 0.02  
 P 2 0.04 0.19  
 T 1 0.01 0.16 0.37  
 P 1 P 2 T 1

## EXAMPLE OF INVERSION DATA SHEET

FIGURE 4-2



$$T_1 = \sqrt{2\pi \rho_1 t 10^{-7}}$$

Where t = time

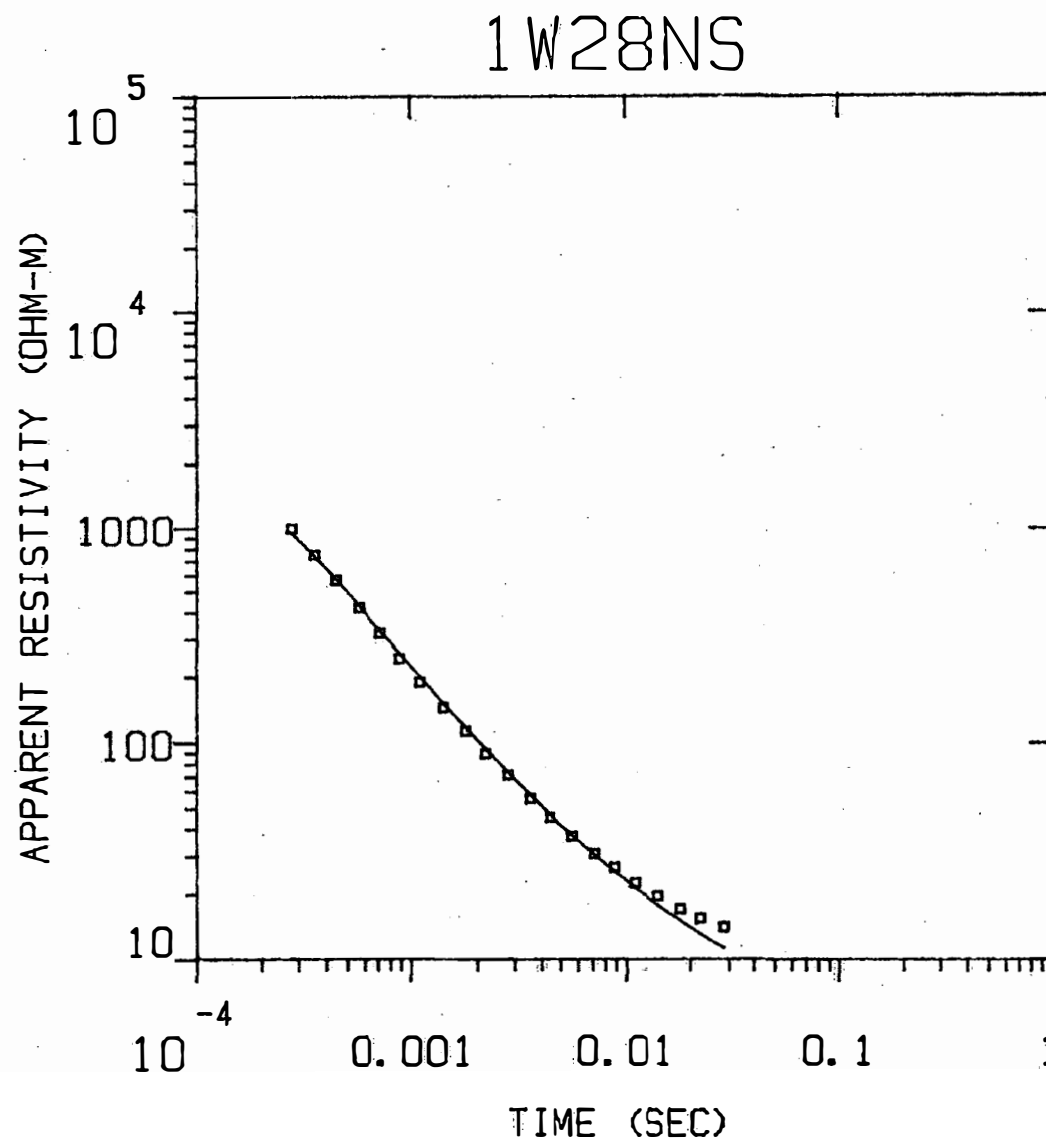
**BLACKHAWK GEOSCIENCES, INC.**

Waikoloa Village TDEM Survey  
**GEOTECHNICAL CONSULTANTS, INC**  
 TWO LAYER MODEL CURVES  
 FOR  $\rho_2 \ll \rho_1$

PROJECT NO.: 88036

FIGURE 4-3





MODEL:

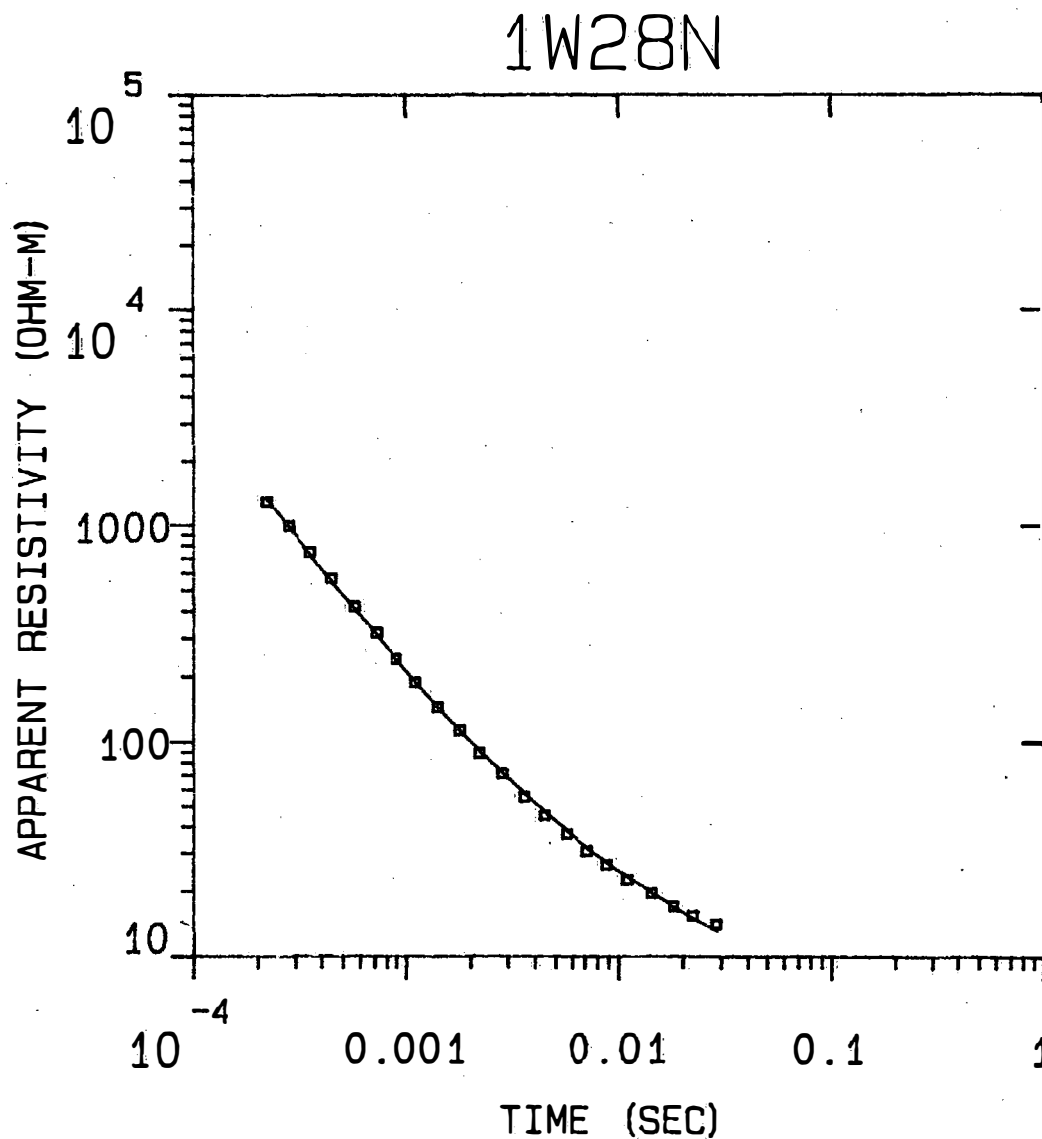
439. OHM-M	280. M
---------------	--------

2.80  
OHM-M

INVERSION RESULTS FOR  
STATION 28N WITH  
 $\rho_2$  HELD FIXED AT 2.8 OHM-M

% ERROR: 12.6  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARRTI

FIGURE 4-4



MODEL:

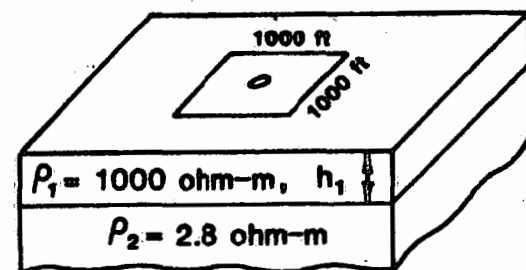
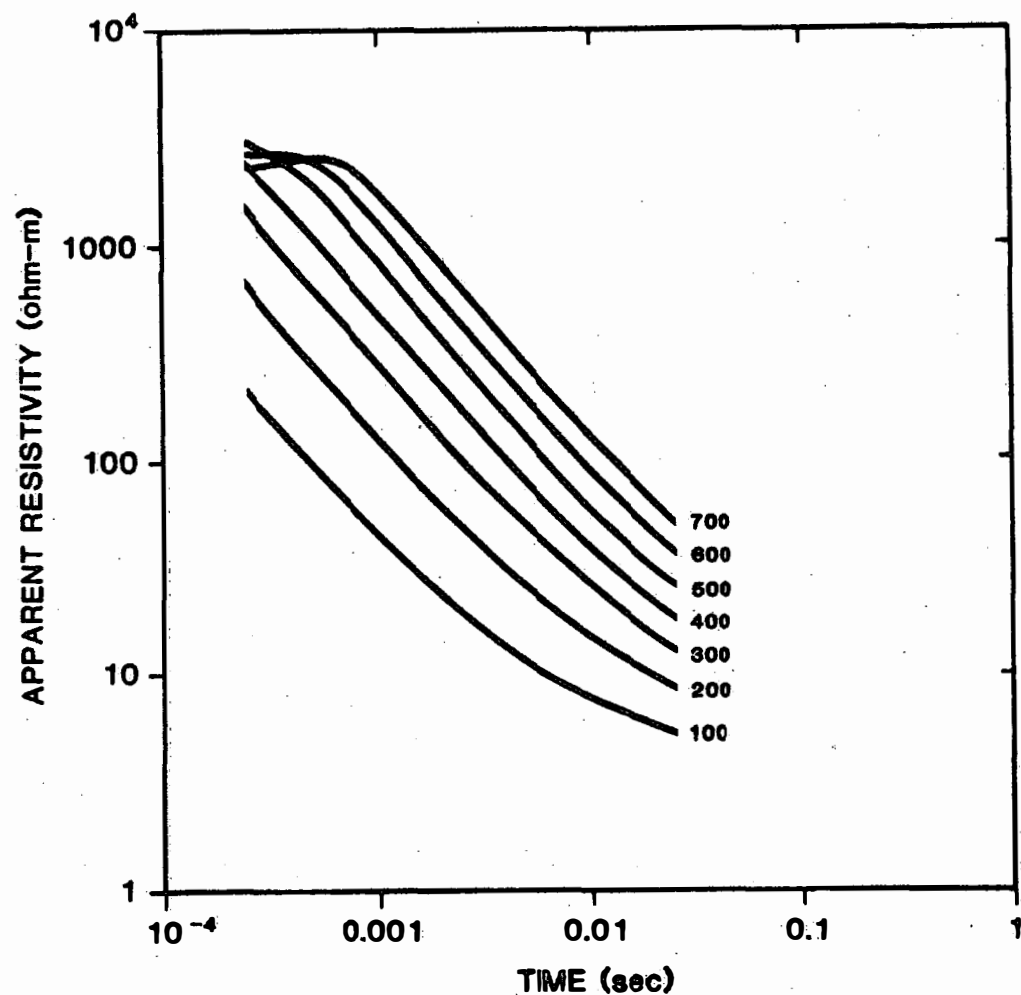
1643.	
OHM-M	271. M

4.15  
OHM-M

INVERSION RESULTS FOR  
STATION 18N  
ALL PARAMETERS FREE

% ERROR: 4.37  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARRTI

FIGURE 4-5



Index of Curves is  $h_1$  (meters)

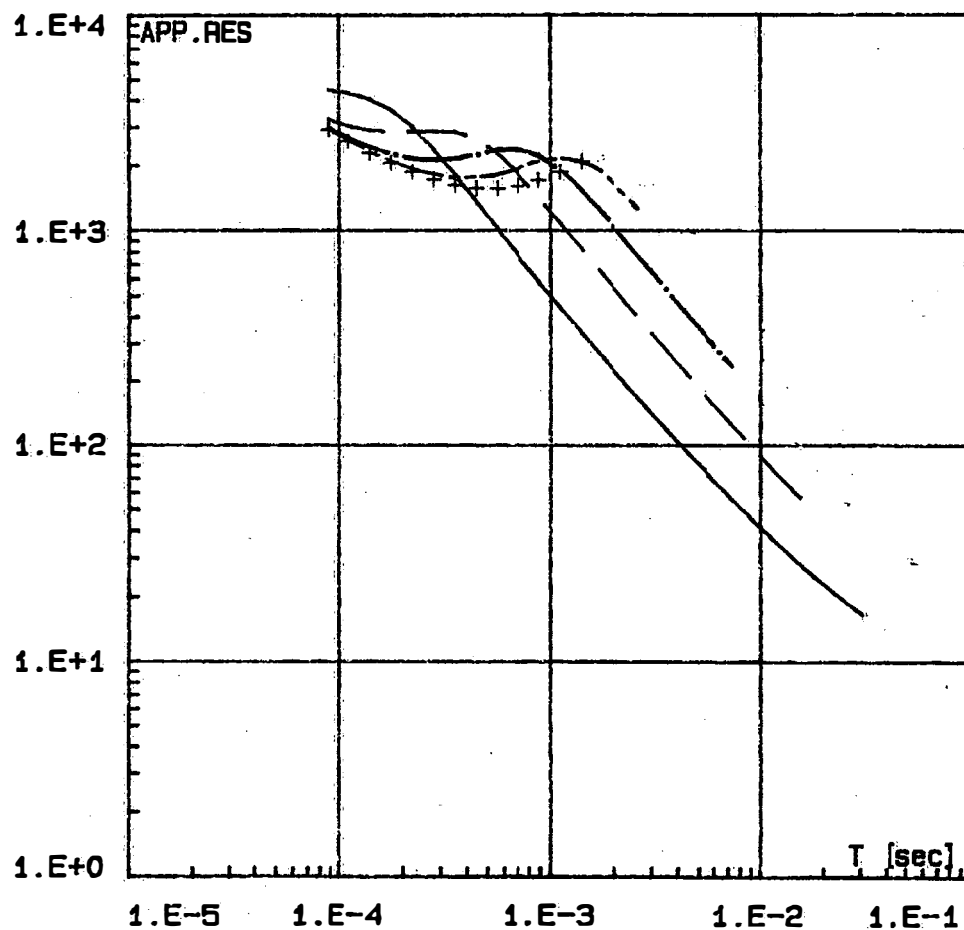
**BLACKHAWK GEOSCIENCES, INC.**

Waikoloa Village TDEM Survey  
**GEOTECHNICAL CONSULTANTS, INC.**  
 FORWARD MODEL CURVES FOR  
 TYPICAL SECTION AT WAIKOLOA

PROJECT NO.: 88036

FIGURE 4-8

# WAIKOLA TEST 1000 FT TX LOOP

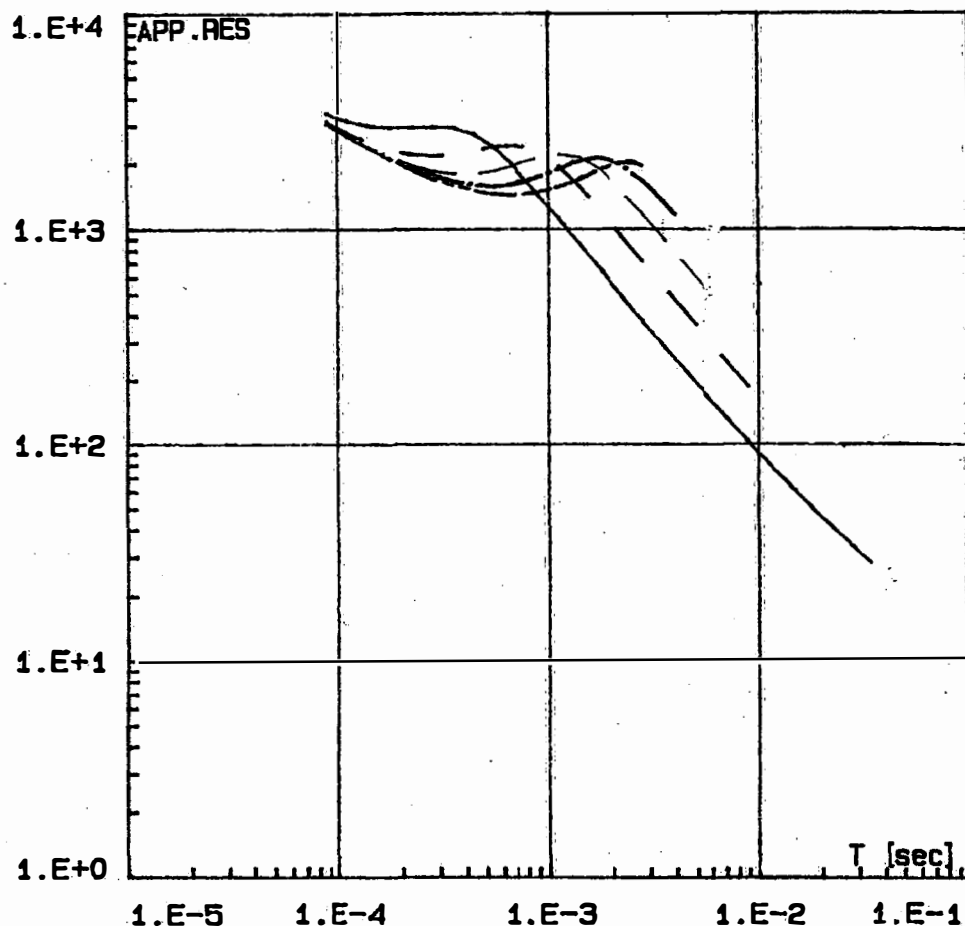


—	model X.DAT	# 1
H	400.00	R <sub>0</sub> 1000.00
	infinite	2.80
- -	model X.DAT	# 2
H	800.00	R <sub>0</sub> 1000.00
	infinite	2.80
- · -	model X.DAT	# 3
H	800.00	R <sub>0</sub> 1000.00
	infinite	2.80
- - -	model X.DAT	# 4
H	1000.00	R <sub>0</sub> 1000.00
	infinite	2.80
+ + +	model X.DAT	# 5
H	1200.00	R <sub>0</sub> 1000.00
	infinite	2.80

EXPLORATION DEPTH  
FOR 1000 ft. x 1000 ft.  
TRANSMITTER LOOPS

FIGURE 4-7

# WAIKOLA TEST 1500 FT TX



- model X.DAT # 12  
H 800.00 R<sub>0</sub> 1000.00  
infinite 2.80
- - model X.DAT # 13  
H 800.00 R<sub>0</sub> 1000.00  
infinite 2.80
- - model X.DAT # 14  
H 1000.00 R<sub>0</sub> 1000.00  
infinite 2.80
- · - model X.DAT # 15  
H 1200.00 R<sub>0</sub> 1000.00  
infinite 2.80
- - - model X.DAT # 16  
H 1400.00 R<sub>0</sub> 1000.00  
infinite 2.80

EXPLORATION DEPTH  
FOR 1500 ft. x 1500 ft.  
TRANSMITTER LOOPS

FIGURE 4-8

## 5.0 RESULTS

In Figure 5-1 a contour map showing the elevation of the 2.8 ohm-m interface from the TDEM inversions is given. Stations where the saline layer was not evident in the data or was beyond effective exploration depths are labeled with "ND". Inversion results for all data are given in the attachment to this report.

Significant depressions in the elevation of the 2.8 ohm-m interface occurs at three areas in the Waikoloa study area, these are (1) near soundings 2, 30, 1 and 5, (2) near soundings 33, 34 and 31, and (3) near soundings 6, 23 and 24. Using the Ghyben-Hertzberg relationship, significant fresh water reserves are inferred in these areas.

Hydrogeologic cross sections drawn through three sections A-A', A-B', and C-C' (see Fig. 2-1) are given in Figure 5-2. Cross section A-A' shows that in the vicinity of the existing wells an increase in the thickness of fresh water is interpreted from the TDEM data. In contrast, along section A-B' no significant thickening of the fresh water lens occurs towards the east (towards higher elevation). Cross section C-C' illustrates another potential drilling target for significant fresh water reserves. This cross section is similar to that of A-A', i.e., a thickening of the fresh water lens is interpreted with increasing distance upslope (to the east). The elevation above sea level of the fresh water is indicated on the sections for each sounding. It is important to note that this interface (top of fresh water) is not directly interpreted from the TDEM data, rather it was back-calculated using the Ghyben-Hertzberg relationship.

Areas where the saline water interface was beyond the depth of exploration (i.e., soundings denoted by "ND") would appear to indicate large fresh water reserves. Most of these areas, however, are at higher elevations and would require drilling to a significant depth to produce (see Fig. 5-1).

In Figure 5-3 a contour map of the ratio of the calculated fresh water lens thickness and the depth to the top of the fresh water is given. This map gives an indication of drilling depth (and pumping expense) for a given volume of ground water reserve. If a minimum value for X for a potential drilling site

can be determined from other hydrogeologic information (i.e., pump tests, historical well information, etc.) than a minimum ratio value  $X/Y$  can be used to help decide on future drill sites. Figure 5-3 shows that the area of the existing drill holes (soundings 2, 30, 1 and 5) has a high ratio of  $X/Y$  at a relatively low elevation, indicating an area with good fresh water reserves at a minimum drilling depth. A similar situation exists near soundings 33 and 34. Although soundings 6, 23 and 24 show a relatively thick fresh water lens, the ratio of  $X/Y$  for these soundings is relatively low because of the higher elevations near these soundings.

Two areas in the Waikoloa survey area display somewhat anomalous behavior in computed depth to saline water (Fig. 5-1). These areas (near sounding 20 and soundings 21 and 16) are anomalous because they show depth to saline water to be shallower than anticipated for their elevation. Additional soundings near these anomalies may have been beneficial in determining the extent of the anomalous areas.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

A total of thirty-five TDEM soundings were accomplished within the Waikoloa Village study area. The interpretation of the TDEM data (Figures 5-1 through 5-3) show that the depth to saline water is quite variable over the study area. The thickness of the fresh water lens can be inferred from the elevation of the saline water derived from TDEM soundings by applying the Ghyben-Herzberg relationship. Three potential areas for significant fresh water reserves at relatively low elevation were mapped. These areas include the area where wells are currently being pumped and drilled (near soundings 2, 30, 1 and 5), areas near soundings 33, 34 and 31, and near soundings 6, 23 and 24. Contours of the ratio of calculated fresh water reserves and depth to these reserves should be of value in selecting future drilling sites.

Over much of the study area above 1,800 ft elevation, the depth to the saline water was not detectable within the limits of exploration of the TDEM system. This infers that significant fresh water reserves exist in these areas; but because of the increase in elevation, the economics of drilling and pumping these reserves must be weighed. Depth of exploration with the Geonics EM-37 for 1,000 ft by 1,000 ft and 1,500 ft by 1,500 ft transmitter loops in the Waikoloa area is about 1,200 m. The accuracy of determining depth to saline water was calculated to be about  $\pm 5\%$ .

The contour map showing the depth to saline water (Fig. 5-1) is based on a limited amount of data. Station spacing over the main area of interest is on the order of 4,000 to 5,000 ft. Additional soundings around anomalous areas or areas of interest may improve the reliability of the contour map results.

*water top  
83°*



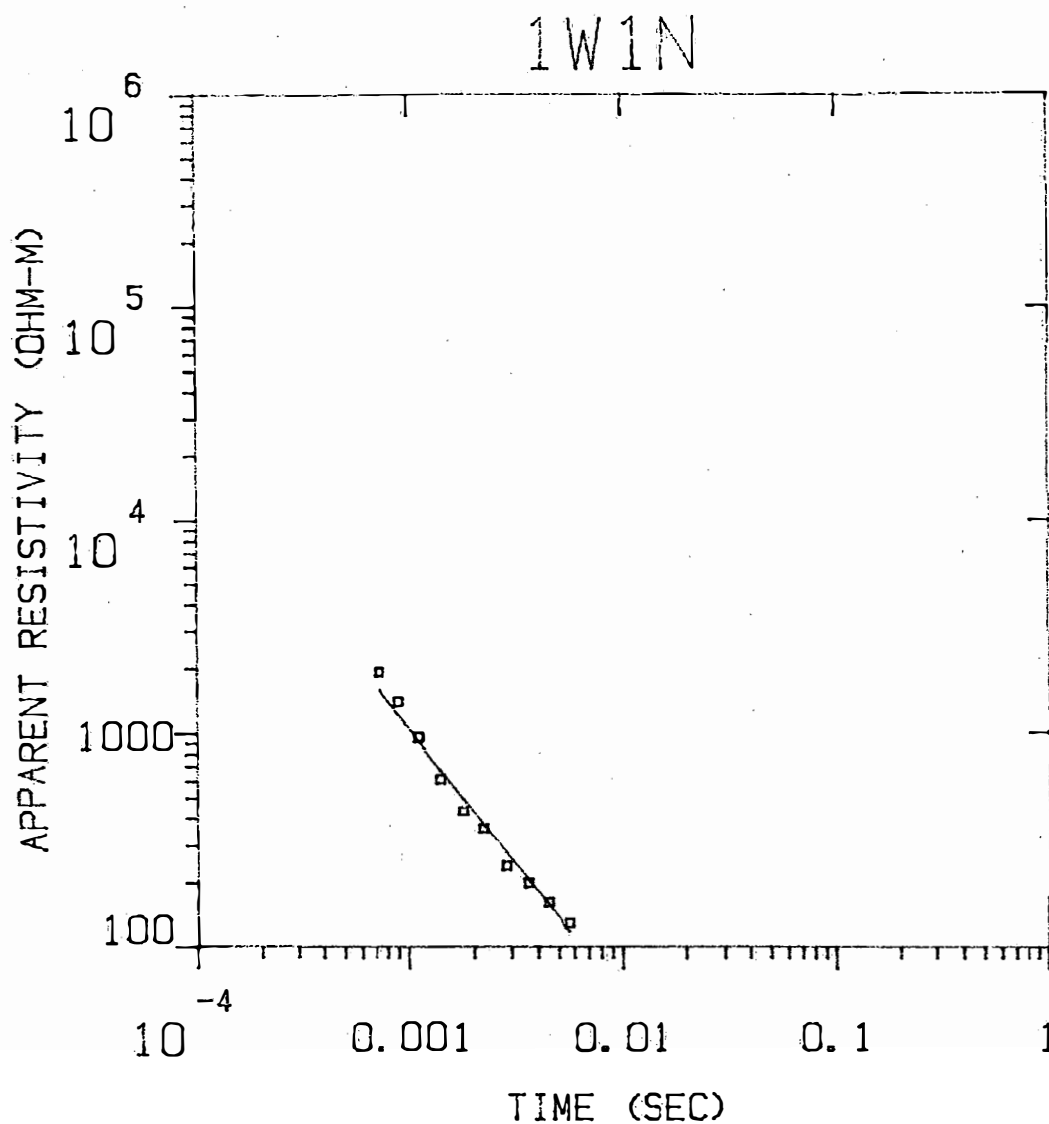
## 7.0 REFERENCES

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Kauahikaua, J. and B. Jackson, 1983. Groundwater exploration using vertical electrical sounding in the south Kohala District, Island of Hawaii, Cooperative Report No. 6, U.S. Department of the Interior.

Kaufman, A.A. and G. Keller, 1983. Frequency and transient soundings, Methods in Geochemistry and Geophysics, V. 16, Elsevier Science Publishing Company, Inc.

Zhody, A. A. and B. Jackson, 1969. Application of deep electrical soundings for ground water exploration in Hawaii, Geophysics, V. 34, P. 584.



MODEL:

4095.

OHM-M

569. M

2.80

OHM-M

% ERROR: 17.6

CALIBRATION: 1

OFFSET: 76.2 M

RAMP: 100.0

INTERPEX: ARRTI

1WIN

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
4094.66	568.7	374.9	1230.0		
2.80		-193.8	-635.9	0.1	0.1

	TIMES	DATA	CALC	% ERROR	STD ERR
1	7.13E-04	1.92E+03	1.60E+03	20.487	
2	8.81E-04	1.40E+03	1.22E+03	14.360	
3	1.10E-03	9.59E+02	9.25E+02	3.599	
4	1.41E-03	6.12E+02	6.73E+02	-9.036	
5	1.80E-03	4.33E+02	4.97E+02	-12.841	
6	2.22E-03	3.60E+02	3.79E+02	-5.142	
7	2.85E-03	2.40E+02	2.79E+02	-13.931	
8	3.60E-03	2.00E+02	2.09E+02	-4.179	
9	4.49E-03	1.62E+02	1.60E+02	1.671	
10	5.70E-03	1.30E+02	1.19E+02	9.463	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000  
TDHZ ARRAY, 10 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: 1WIN  
WAIKOLOA  
500 FT LOOP  
RMS LOG ERROR: 7.06E-02, ANTILOG YIELDS 17.6492 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

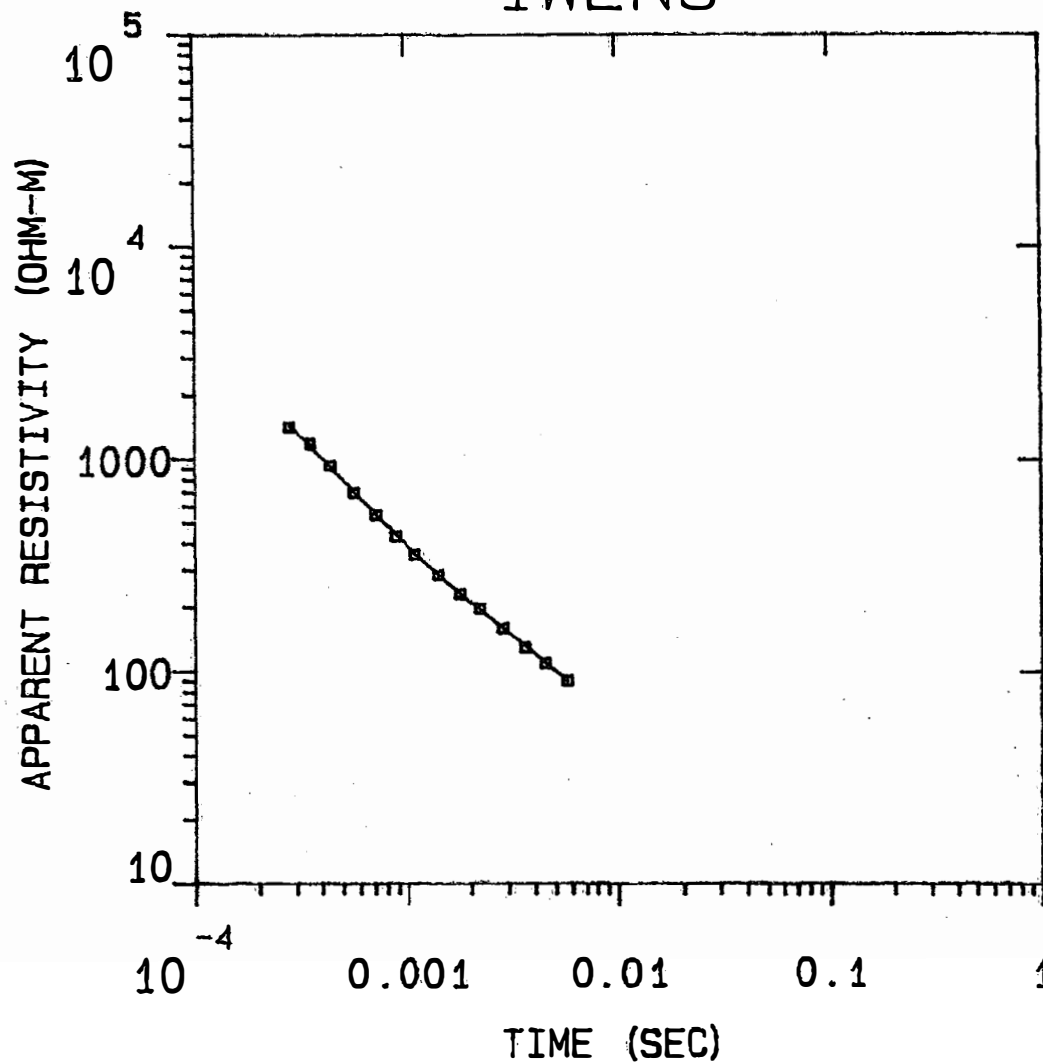
P 1 0.00

F 2 0.00 0.00

T 1 0.00 0.00 0.98

P 1 F 2 T 1

1W2NS



MODEL:

792. OHM-M	387. M
---------------	--------

9.68 OHM-M	144. M
---------------	--------

2.80 OHM-M
---------------

% ERROR: 2.04  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 165.0  
INTERPEX: ARRTI

1W2NS

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	TOTAL
792.33	386.9	538.5	1110.0	0.5	0.5
9.63	143.6	-48.6	-159.5	14.8	15.3
2.80		-192.2	-630.5		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.80E-04	1.42E+03	1.44E+03	-1.679	
2	3.55E-04	1.18E+03	1.15E+03	2.411	
3	4.43E-04	9.32E+02	9.15E+02	1.886	
4	5.64E-04	6.93E+02	7.00E+02	-0.939	
5	7.13E-04	5.44E+02	5.46E+02	-0.370	
6	8.81E-04	4.32E+02	4.41E+02	-2.088	
7	1.10E-03	3.54E+02	3.56E+02	-0.795	
8	1.41E-03	2.84E+02	2.83E+02	0.316	
9	1.80E-03	2.32E+02	2.31E+02	0.466	
10	2.22E-03	1.97E+02	1.93E+02	1.741	
11	2.65E-03	1.59E+02	1.59E+02	0.127	
12	3.60E-03	1.30E+02	1.32E+02	-1.745	
13	4.49E-03	1.09E+02	1.09E+02	-0.135	
14	5.70E-03	9.05E+01	8.97E+01	0.861	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 14 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: 1W2NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 8.76E-03, ANTILOG YIELDS 2.0375 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.83

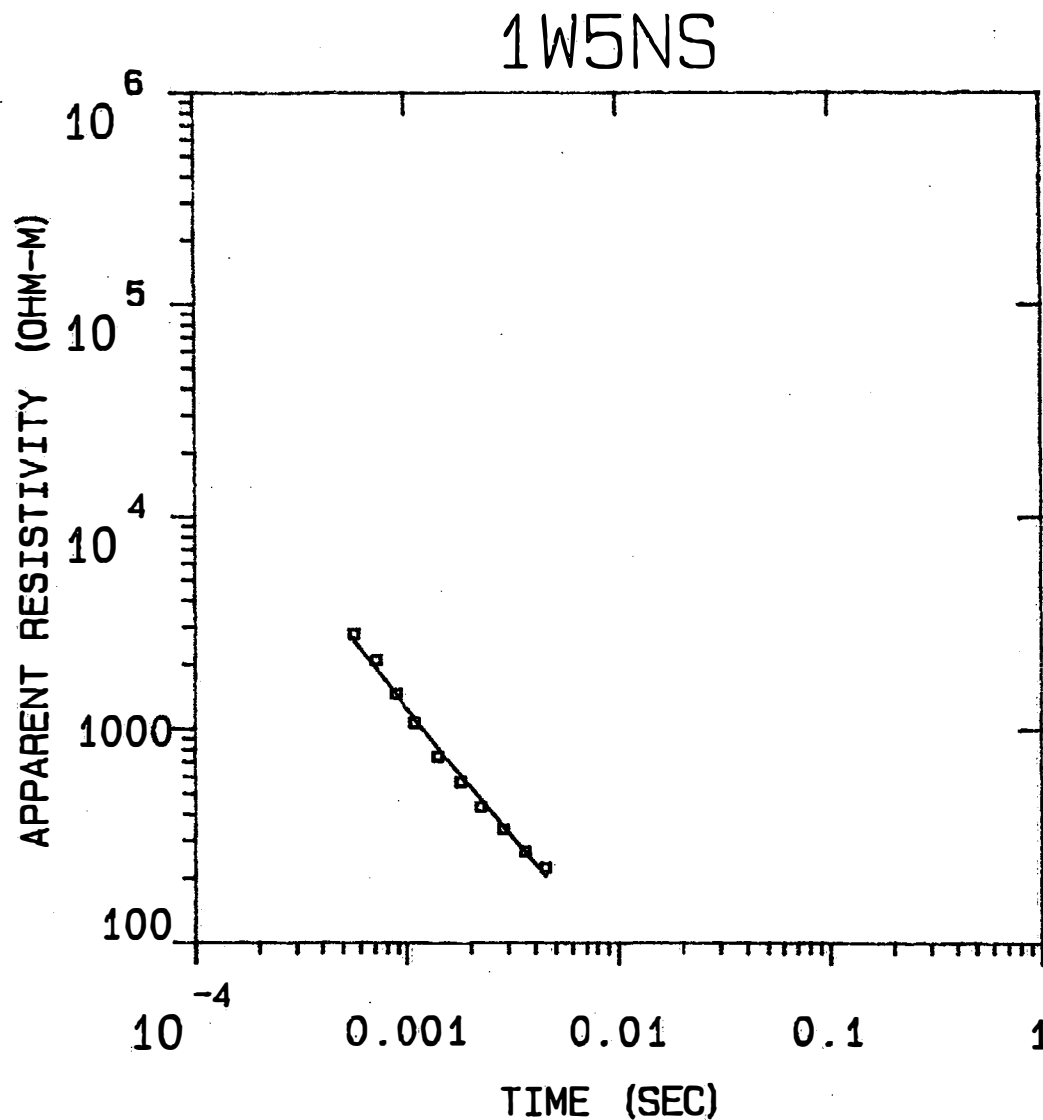
P 2 -0.06 0.92

F 3 0.00 0.00 0.00

T 1 0.01 0.00 0.00 1.00

T 2 0.00 -0.06 0.00 -0.01 0.81

P 1 P 2 F 3 T 1 T 2



MODEL:

3802.  
OHM-M

592. M

2.81  
OHM-M

% ERROR: 10.2  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 165.0  
INTERPEX: ARRTI

1WSNS

MODEL: 2 LAYERS.

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (N)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
3801.55	591.6	379.5	-1245.0	0.2	0.2
2.81		-212.2	-696.1		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	5.64E-04	2.78E+03	2.58E+03	7.932	
2	7.13E-04	2.10E+03	1.91E+03	9.804	
3	8.81E-04	1.46E+03	1.46E+03	-0.045	
4	1.10E-03	1.07E+03	1.11E+03	-3.512	
5	1.41E-03	7.45E+02	8.14E+02	-8.386	
6	1.80E-03	5.69E+02	6.06E+02	-6.162	
7	2.22E-03	4.34E+02	4.68E+02	-7.282	
8	2.85E-03	3.41E+02	3.48E+02	-1.928	
9	3.60E-03	2.68E+02	2.65E+02	1.143	
10	4.49E-03	2.25E+02	2.05E+02	9.564	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 10 DATA POINTS, RAMP: 165.0 MICROSEC. DATA: 1WSNS  
WAIKOLOA  
100 FT LOOP  
RMS LOG ERROR: 4.23E-02, ANTILOG YIELDS 10.2264 %  
LATE TIME PARAMETERS

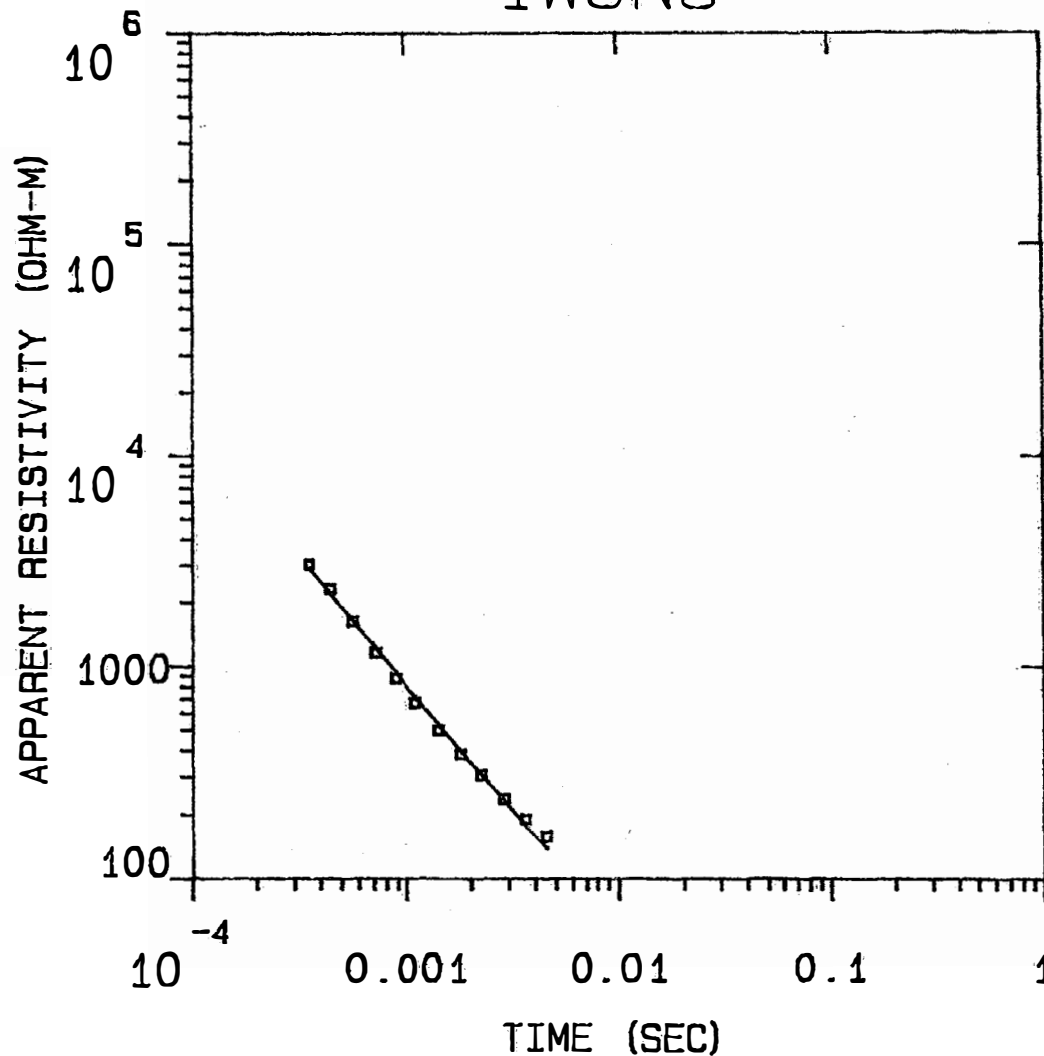
\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
"F" MEANS FIXED PARAMETER

P 1 0.14  
P 2 -0.18 0.37  
T 1 -0.02 -0.05 0.99  
P 1 P 2 T 1

1W6NS

MODEL:



1737.  
OHM-M

492. M

2.80  
OHM-M

% ERROR: 8.98  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI



1W6NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
1736.91	491.6	393.2	1290.0	0.3	0.3
2.80		-98.4	-322.8		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	3.55E-04	3.02E+03	2.94E+03	2.838	
2	4.43E-04	2.32E+03	2.21E+03	4.993	
3	5.64E-04	1.63E+03	1.63E+03	-0.100	
4	7.13E-04	1.16E+03	1.22E+03	-4.733	
5	8.81E-04	8.80E+02	9.39E+02	-6.221	
6	1.10E-03	6.71E+02	7.16E+02	-6.516	
7	1.41E-03	4.99E+02	5.29E+02	-5.706	
8	1.80E-03	3.84E+02	3.96E+02	-3.112	
9	2.22E-03	3.06E+02	3.08E+02	-0.553	
10	2.85E-03	2.36E+02	2.31E+02	2.136	
11	3.60E-03	1.90E+02	1.77E+02	7.097	
12	4.49E-03	1.58E+02	1.39E+02	13.430	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY. 12 DATA POINTS. RAMP: 205.0 MICROSEC. DATA: 1W6NS  
 WAIKOLOA  
 100 FT LOOP  
 RMS LOG ERROR: 3.73E-02. ANTILOG YIELDS 8.9763 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

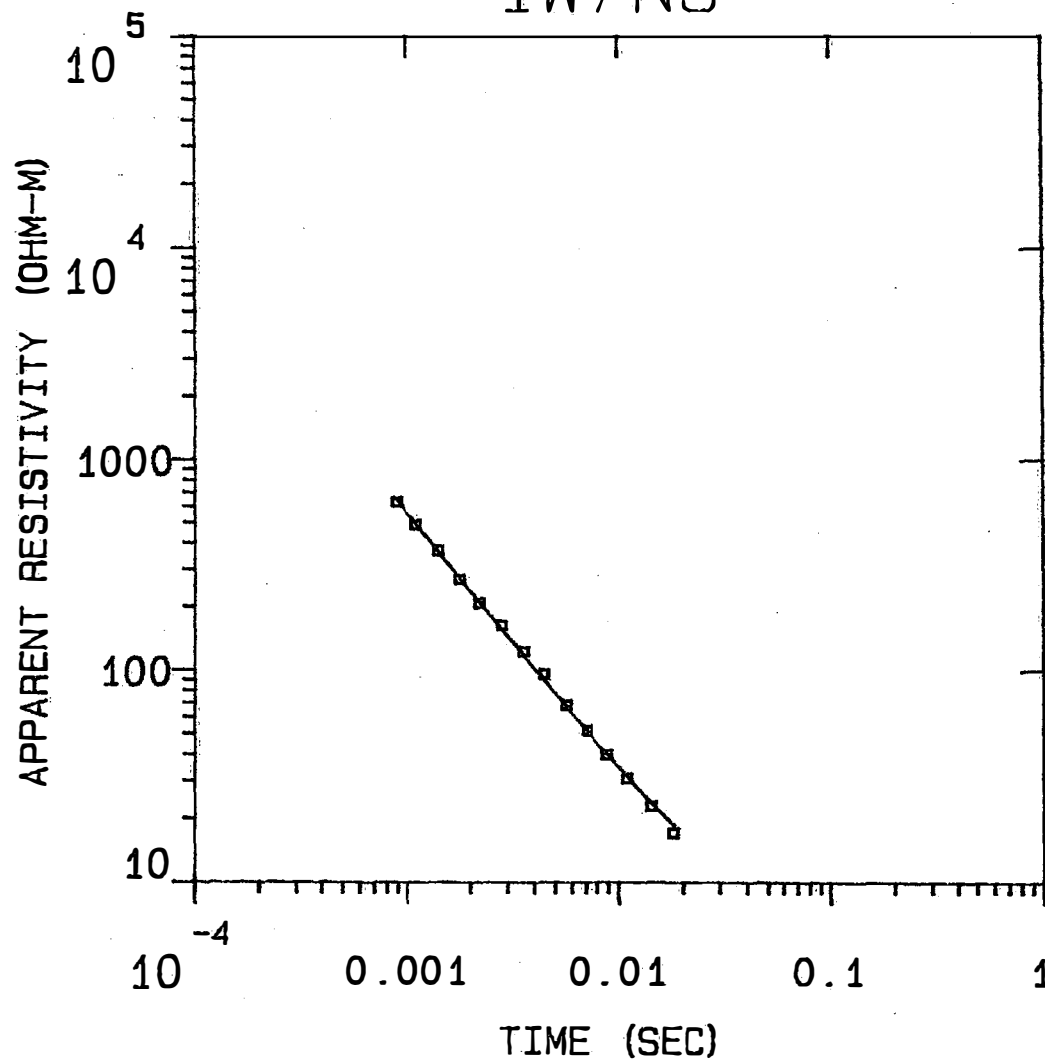
PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER:

P 1	0.96		
F 2	0.00	0.00	
T 1	0.00	0.00	1.00
	P 1	F 2	T 1

1W7NS

MODEL:



23169.  
OHM-M

424. M

2.80  
OHM-M

% ERROR: 5.63  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARRTI

1W7NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
22177.32	425.1	359.7	1180.0	0.0	0.0
2.30		-65.5	-214.8		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.85E-04	6.30E+02	6.32E+02	-3.433	
2	1.10E-03	4.89E+02	4.96E+02	-1.504	
3	1.41E-03	3.68E+02	3.63E+02	1.320	
4	1.77E-03	2.69E+02	2.72E+02	-1.356	
5	2.20E-03	2.07E+02	2.09E+02	-0.914	
6	2.80E-03	1.63E+02	1.56E+02	4.364	
7	3.55E-03	1.23E+02	1.17E+02	4.398	
8	4.43E-03	9.56E+01	8.97E+01	6.499	
9	5.64E-03	6.84E+01	6.72E+01	1.775	
10	7.13E-03	5.19E+01	5.12E+01	1.324	
11	8.81E-03	3.99E+01	4.01E+01	-0.582	
12	1.10E-02	3.08E+01	3.14E+01	-2.089	
13	1.41E-02	2.28E+01	2.36E+01	-3.199	
14	1.80E-02	1.70E+01	1.85E+01	-8.017	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 14 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1W7NS  
WAIKOLOA  
1000 FT LOOP  
RMS LOG ERROR: 2.37E-02, ANTILOG YIELDS 5.6098 %  
LATE TIME PARAMETERS

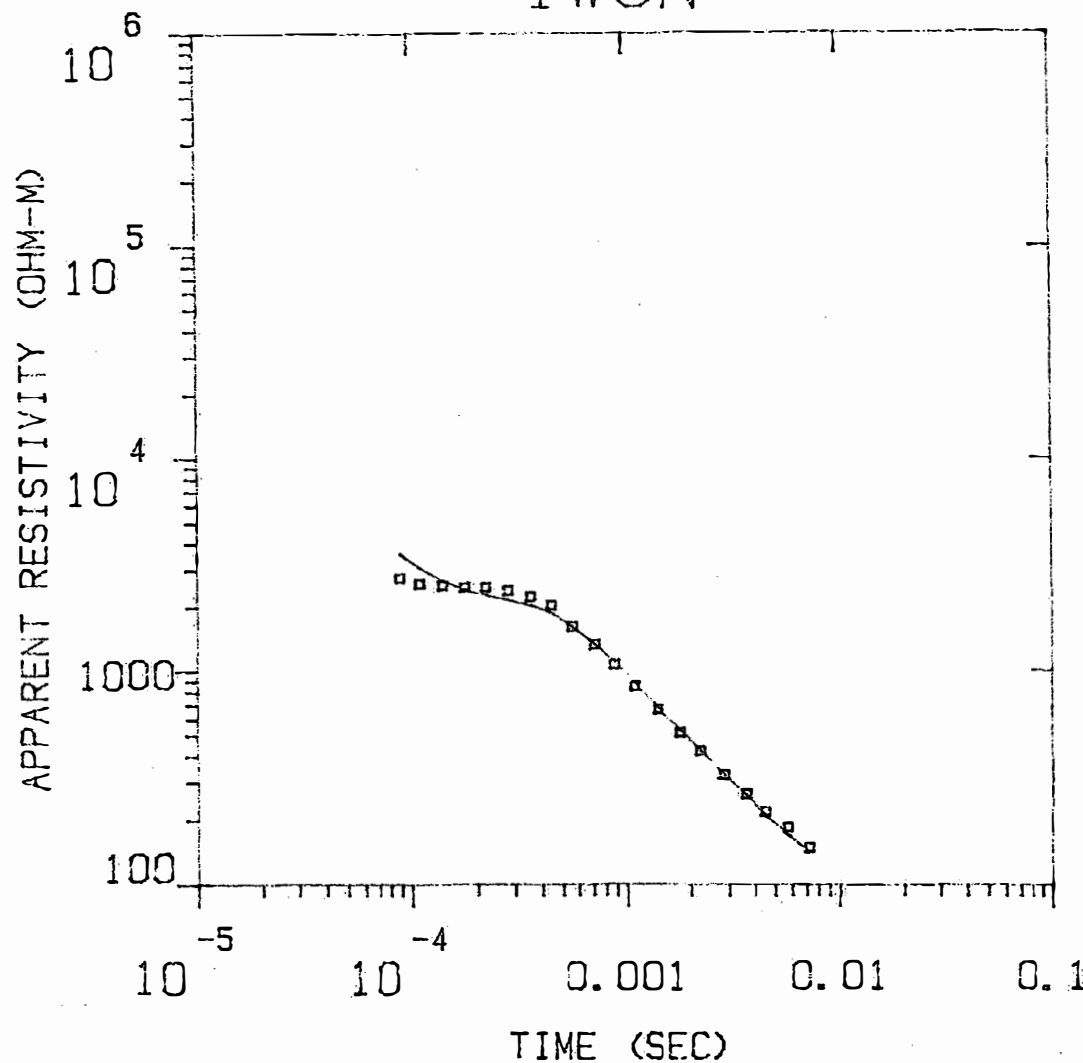
\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
"F" MEANS FIXED PARAMETER  
P 1 0.15  
P 2 0.00 0.00  
T 1 0.00 0.00 1.00  
P 1 F 2 T 1

External Loop  
Sounding

1W8N

MODEL:



628.  
OHM-M

501. M

11.2  
OHM-M

% ERROR: 14.1  
CALIBRATION: 1  
OFFSET: 305 M  
RAMP: 200.0  
INTERPEX: ARRTI

1W8N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION		CONDUCTANCE (S) LAYER	(S) TOTAL
		(M)	(FEET)		
627.71	500.7	365.8	1200.0	0.8	0.8
11.24		-134.9	-442.6		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	-2.08E+03	2.73E+03	-176.239	
2	1.10E-04	-1.96E+03	2.34E+03	-183.854	
3	1.40E-04	-1.92E+03	2.03E+03	-194.541	
4	1.77E-04	-1.90E+03	1.84E+03	-202.910	
5	2.20E-04	-1.89E+03	1.73E+03	-209.035	
6	2.80E-04	-1.82E+03	1.64E+03	-210.879	
7	3.55E-04	-1.70E+03	1.55E+03	-209.384	
8	4.43E-04	-1.55E+03	1.43E+03	-208.209	
9	5.64E-04	-1.24E+03	1.24E+03	-199.954	
10	7.13E-04	-1.02E+03	1.03E+03	-199.244	
11	8.81E-04	-8.17E+02	8.47E+02	-196.444	
12	1.10E-03	-6.52E+02	6.74E+02	-196.744	
13	1.41E-03	-5.07E+02	5.17E+02	-198.176	
14	1.80E-03	-3.91E+02	4.03E+02	-197.217	
15	2.22E-03	-3.19E+02	3.23E+02	-198.946	
16	2.85E-03	-2.49E+02	2.51E+02	-199.206	
17	3.60E-03	-2.02E+02	2.00E+02	-201.167	
18	4.49E-03	-1.67E+02	1.62E+02	-203.052	
19	5.70E-03	-1.41E+02	1.30E+02	-207.823	
20	7.19E-03	-1.13E+02	1.07E+02	-205.378	

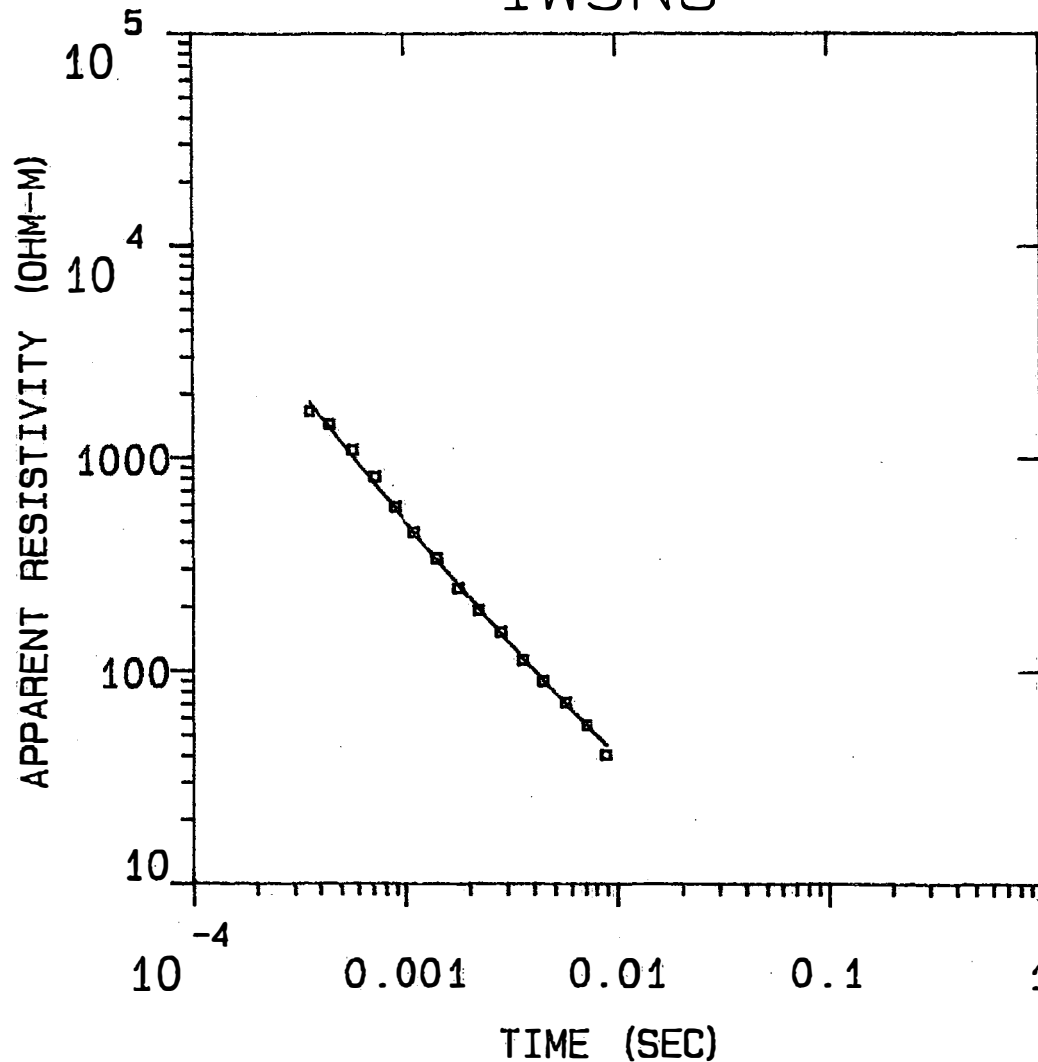
R: 305. X: 305. Y: 152. DA: 0.09 ASP: 1.000 CF: 1.0000  
 TLHZ ARRAY, 20 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1W8N  
 EXTERNAL SENDING  
 1000 FT LOOP  
 RMS LOG ERROR: 5.72E-02, ANTILOG YIELDS 14.0792 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 1.00  
 P 2 0.00 1.00  
 T 1 0.00 0.00 1.00  
 P 1 P 2 T 1

1W9NS

MODEL:



4881.  
OHM-M

396. M

2.80  
OHM-M

% ERROR: 7.76  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARTTI

1W9NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION		CONDUCTANCE (S)	
		(N)	(FEET)	LAYER	TOTAL
4881.42	395.9	356.6	1170.0		
2.80		-39.3	-129.0	0.1	0.1

	TIMES	DATA	CALC	% ERROR	STD ERR
1	3.55E-04	1.66E+03	1.85E+03	-10.367	
2	4.43E-04	1.44E+03	1.39E+03	3.722	
3	5.64E-04	1.09E+03	1.02E+03	7.070	
4	7.13E-04	8.15E+02	7.57E+02	7.651	
5	8.85E-04	5.89E+02	5.79E+02	1.773	
6	1.10E-03	4.47E+02	4.44E+02	0.636	
7	1.41E-03	3.36E+02	3.30E+02	1.853	
8	1.77E-03	2.44E+02	2.52E+02	-3.041	
9	2.20E-03	1.93E+02	1.95E+02	-1.386	
10	2.80E-03	1.52E+02	1.49E+02	1.922	
11	3.55E-03	1.13E+02	1.15E+02	-1.417	
12	4.43E-03	8.97E+01	9.03E+01	-0.653	
13	5.64E-03	7.12E+01	7.03E+01	1.276	
14	7.13E-03	5.57E+01	5.53E+01	0.695	
15	8.81E-03	4.05E+01	4.51E+01	-10.023	

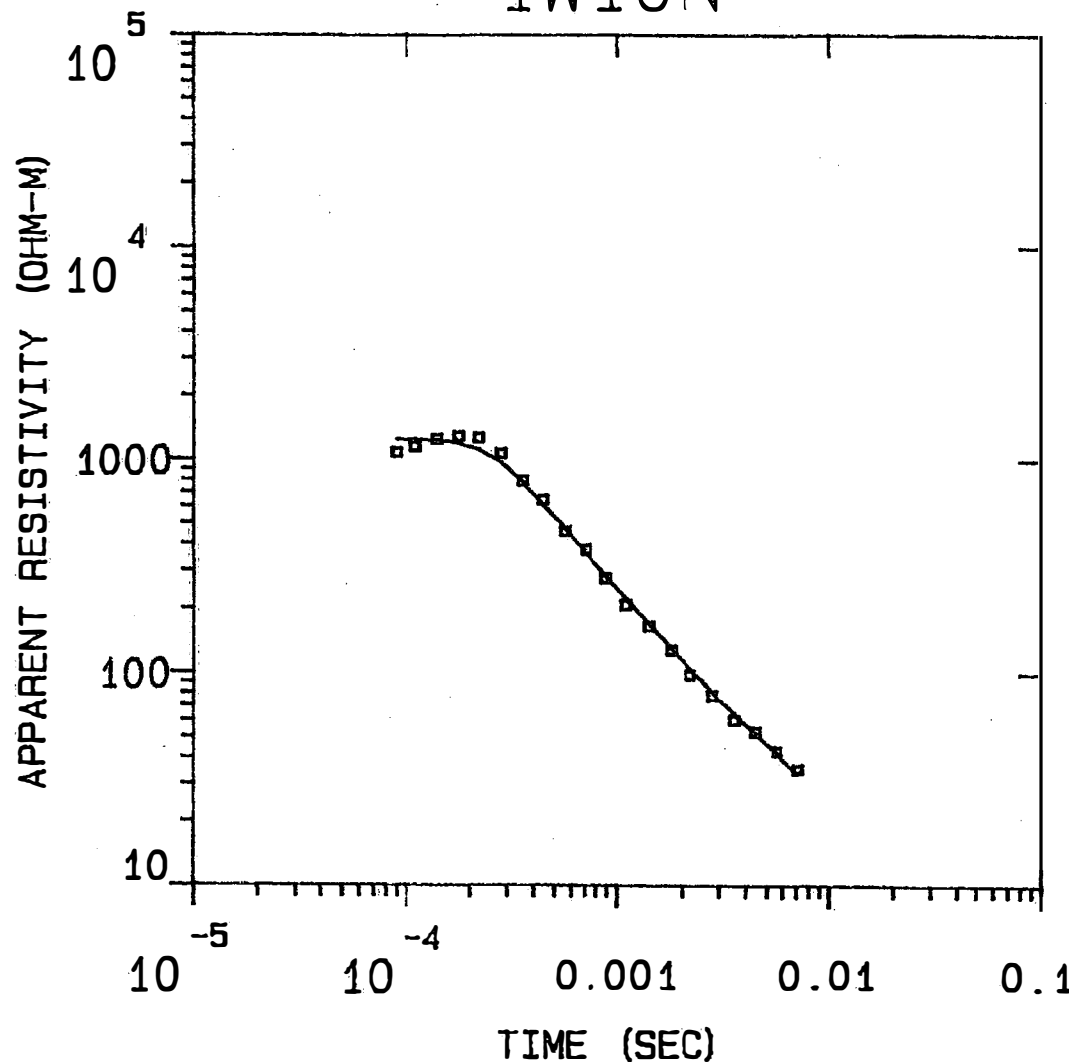
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 15 DATA POINTS, RAMP: 200.0 MICROSEC. DATA: 1W9NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 3.25E-02, ANTILOG YIELDS 7.7586 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 0.03  
 F 2 0.00 0.00  
 T 1 0.00 0.00 1.00  
 P 1 F 2 F 1

1W10N

MODEL:



485.  
OHM-M

306. M

2.80  
OHM-M

% ERROR: 10.2  
CALIBRATION: 1  
OFFSET: 76.2 M  
RAMP: 110.0  
INTERPEX: ARRTI



# 1W10M

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	TOTAL
484.79	305.6	257.6	845.0	0.6	0.6
2.80		-48.1	-157.8		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.08E+03	1.24E+03	-13.130	
2	1.10E-04	1.15E+03	1.23E+03	-6.700	
3	1.40E-04	1.25E+03	1.23E+03	1.681	
4	1.77E-04	1.29E+03	1.19E+03	8.618	
5	2.20E-04	1.26E+03	1.10E+03	14.055	
6	2.80E-04	1.07E+03	9.67E+02	10.227	
7	3.55E-04	7.90E+02	7.76E+02	1.797	
8	4.43E-04	6.45E+02	6.11E+02	5.689	
9	5.64E-04	4.60E+02	4.73E+02	-2.652	
10	7.13E-04	3.76E+02	3.61E+02	4.152	
11	8.85E-04	2.77E+02	2.82E+02	-1.918	
12	1.10E-03	2.08E+02	2.22E+02	-6.328	
13	1.41E-03	1.66E+02	1.69E+02	-2.108	
14	1.78E-03	1.28E+02	1.30E+02	-1.712	
15	2.20E-03	9.78E+01	1.05E+02	-6.513	
16	2.80E-03	7.88E+01	8.16E+01	-3.427	
17	3.55E-03	6.05E+01	6.43E+01	-5.927	
18	4.43E-03	5.33E+01	5.20E+01	2.345	
19	5.64E-03	4.31E+01	4.15E+01	4.037	
20	7.13E-03	3.54E+01	3.38E+01	4.739	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000  
 TDHZ ARRAY, 20 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: 1W10M  
 NEAR BRACKISH WELL  
 WAIKOLOA  
 RMS LOG ERROR: 4.21E-02, ANTILOG YIELDS 10.1711 %  
 LATE TIME PARAMETERS:

\* BLACKHAWK GEOSCIENCES, INC. \*

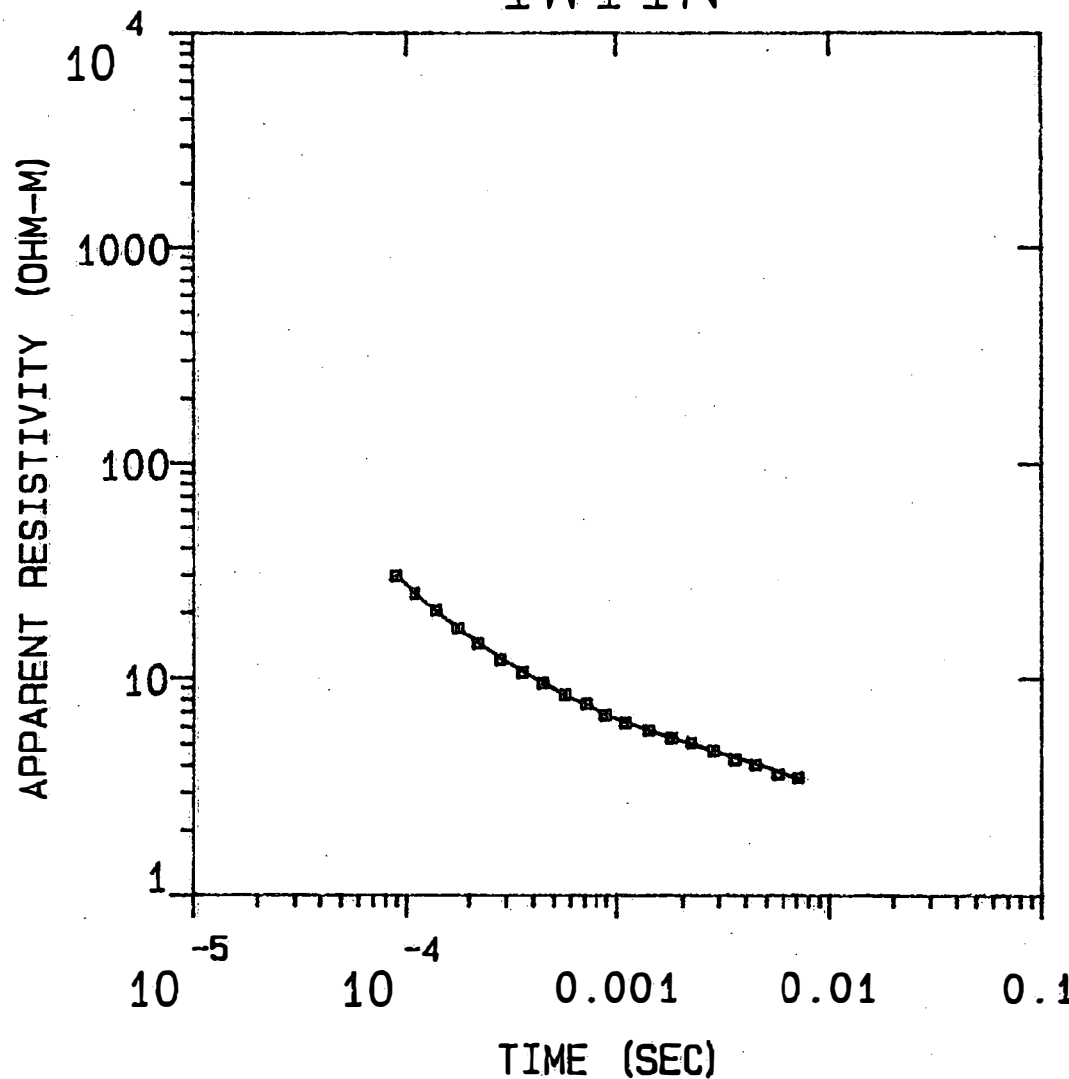
## PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	1.00		
F 2	0.00	0.00	
T 1	0.00	0.00	1.00
	P 1	F 2	T 1

1W11N

MODEL:



619.  
OHM-M

27.8 M

2.87  
OHM-M

% ERROR: 1.83  
CALIBRATION: 1  
OFFSET: 19.1 M  
RAMP: 35.0  
INTERPEX: ARRTI

1W11N

MODEL: 2 LAYERS

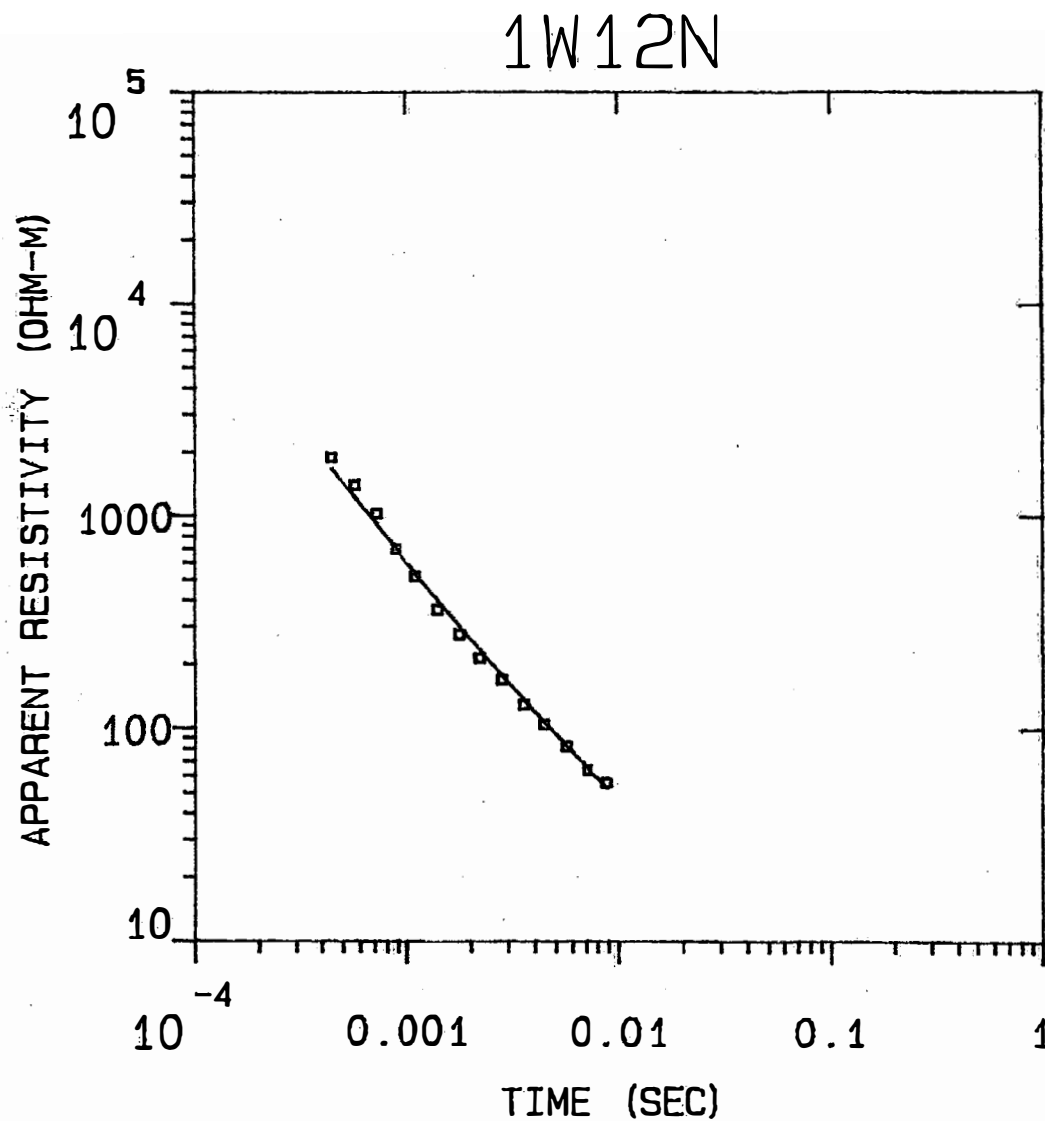
RESISTIVITY THICKNESS (OHM-M) (M)		ELEVATION (M) (FEET)		CONDUCTANCE (S)	
				LAYER	TOTAL
618.90	27.8	24.4	80.0		
2.87		-3.5	-11.3	0.0	0.0

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.98E+01	3.00E+01	-0.506	
2	1.10E-04	2.46E+01	2.49E+01	-0.938	
3	1.40E-04	2.06E+01	2.03E+01	1.322	
4	1.77E-04	1.70E+01	1.70E+01	0.205	
5	2.20E-04	1.44E+01	1.45E+01	-0.719	
6	2.80E-04	1.22E+01	1.23E+01	-1.149	
7	3.55E-04	1.06E+01	1.07E+01	-0.871	
8	4.43E-04	9.49E+00	9.44E+00	0.527	
9	5.64E-04	8.40E+00	8.33E+00	0.768	
10	7.13E-04	7.64E+00	7.50E+00	1.846	
11	8.85E-04	6.81E+00	6.81E+00	-0.013	
12	1.10E-03	6.26E+00	6.28E+00	-0.327	
13	1.41E-03	5.79E+00	5.75E+00	0.696	
14	1.78E-03	5.35E+00	5.31E+00	0.800	
15	2.21E-03	5.08E+00	4.99E+00	1.807	
16	2.83E-03	4.67E+00	4.64E+00	0.638	
17	3.55E-03	4.26E+00	4.35E+00	-2.123	
18	4.43E-03	4.04E+00	4.08E+00	-1.031	
19	5.64E-03	3.67E+00	3.77E+00	-2.550	
20	7.13E-03	3.53E+00	3.47E+00	1.484	

R: 19. X: 0. Y: 19. DL: 38. REQ: 21. CF: 1.0000  
 TDHZ ARRAY, 20 DATA POINTS, RAMP: 35.0 MICROSEC, DATA: 1W11N  
 WAIKOLOA  
 NEAR OCEAN  
 RMS LOG ERROR: 7.86E-03, ANTILOG YIELDS 1.8258 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 0.02  
 P 2 -0.04 0.19  
 T 1 -0.01 0.16 0.37  
 P 1 P 2 T 1



MODEL:

3320.  
OHM-M

429. M

2.80  
OHM-M

% ERROR: 12.0  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARTI

1W12H

MODEL: 2 LAYERS

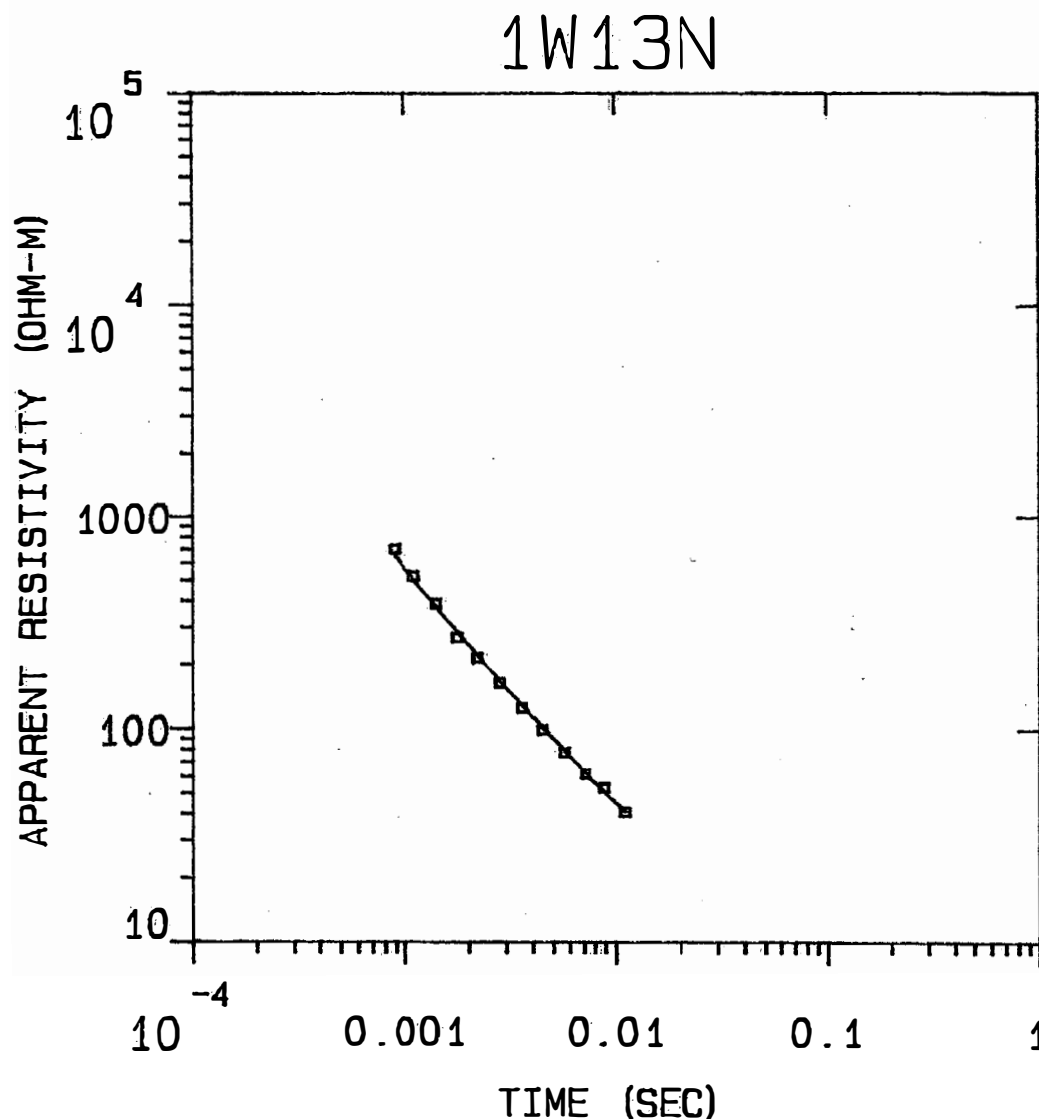
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	TOTAL
3320.26	429.1	359.7	1180.0	0.1	0.1
2.80		-69.4	-227.9		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	1.89E+03	1.66E+03	13.750	
2	5.64E-04	1.39E+03	1.22E+03	13.685	
3	7.13E-04	1.02E+03	9.08E+02	12.012	
4	8.85E-04	6.97E+02	6.92E+02	0.687	
5	1.10E-03	5.18E+02	5.31E+02	-2.484	
6	1.40E-03	3.59E+02	3.96E+02	-9.413	
7	1.77E-03	2.76E+02	2.99E+02	-7.924	
8	2.20E-03	2.13E+02	2.33E+02	-8.418	
9	2.80E-03	1.69E+02	1.77E+02	-4.237	
10	3.55E-03	1.29E+02	1.35E+02	-4.738	
11	4.43E-03	1.04E+02	1.07E+02	-2.477	
12	5.64E-03	8.22E+01	8.25E+01	-0.315	
13	7.13E-03	6.41E+01	6.50E+01	-1.439	
14	8.81E-03	5.59E+01	5.27E+01	5.949	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 14 DATA POINTS. RAMP: 200.0 MICROSEC, DATA: 1W12H  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 4.90E-02, ANTILOG YIELDS 11.9541 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 0.04  
 F 2 0.00 0.00  
 T 1 0.01 0.00 1.00  
 P 1 F 2 T 1



MODEL:

3115. OHM-M	419. M
----------------	--------

2.80  
OHM-M

% ERROR: 5.54  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARTTI

1WJ3M

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	TOTAL
3115.24	418.8	253.6	1160.0	0.1	0.1
2.80		-65.2	-213.9		

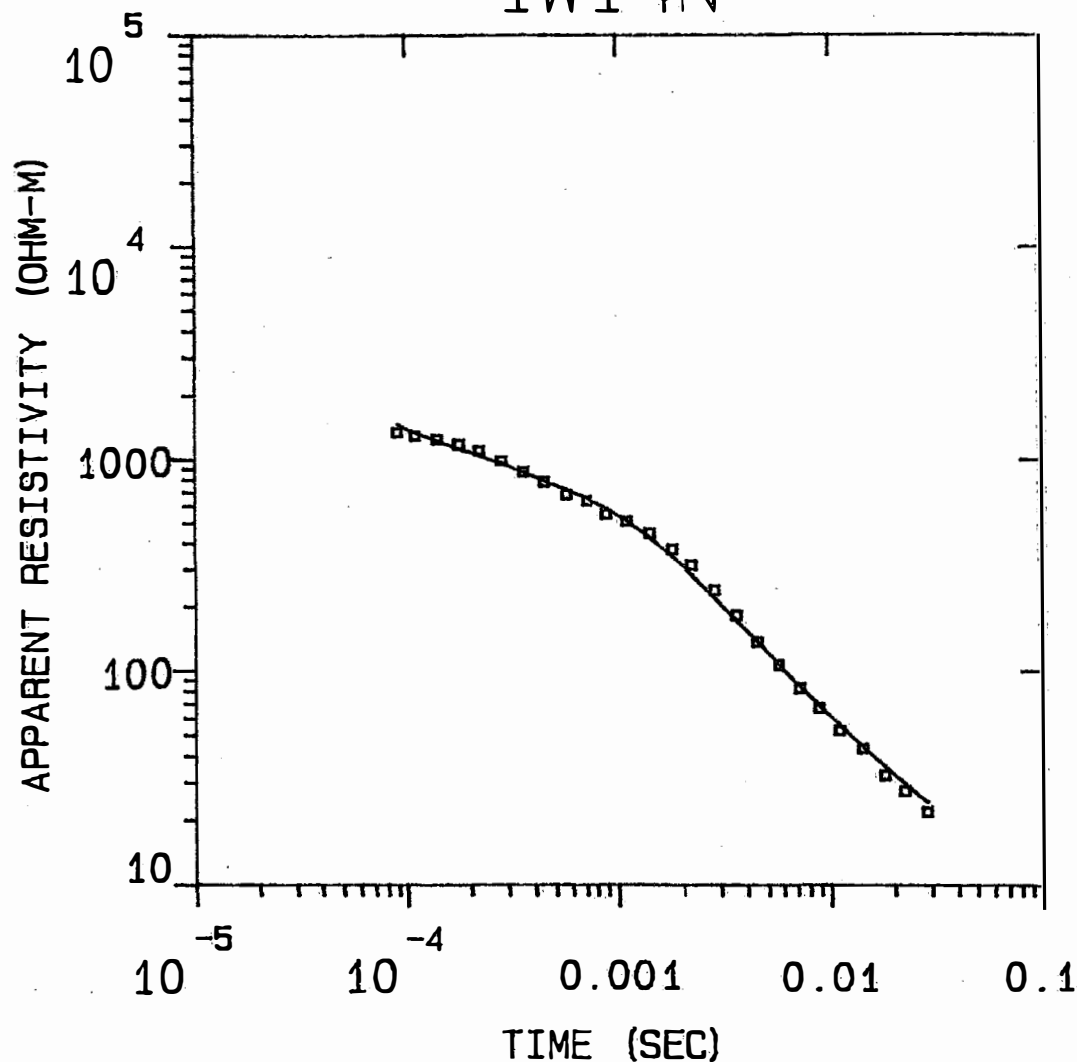
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.85E-04	7.01E+02	6.55E+02	7.068	
2	1.10E-03	5.23E+02	5.02E+02	4.095	
3	1.41E-03	3.86E+02	3.73E+02	3.499	
4	1.77E-03	2.68E+02	2.84E+02	-5.535	
5	2.20E-03	2.14E+02	2.21E+02	-2.800	
6	2.60E-03	1.65E+02	1.68E+02	-1.979	
7	3.55E-03	1.26E+02	1.29E+02	-2.379	
8	4.43E-03	9.91E+01	1.02E+02	-2.381	
9	5.64E-03	7.75E+01	7.87E+01	-1.546	
10	7.13E-03	6.18E+01	6.20E+01	-0.403	
11	8.81E-03	5.29E+01	5.05E+01	4.771	
12	1.10E-02	4.08E+01	4.09E+01	-0.375	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 10HZ ARRAY, 12 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1WJ3M  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 2.34E-02, ANTILOG YIELDS 5.5408 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 0.16  
 P 2 0.00 0.00  
 T 1 -0.01 0.00 1.00  
 P 1 F 2 T 1

1W14N



MODEL:

497.  
OHM-M 392. M

33.6  
OHM-M 117. M

2.80  
OHM-M

% ERROR: 8.91  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARRTI



1W14N

MODEL: 3 LAYERS

RESISTIVITY THICKNESS		ELEVATION		CONDUCTANCE (S)	
(OHM-M)	(M)	(M)	(FEET)	LAYER	TOTAL
496.97	391.6	426.7	1400.0	0.8	0.8
33.56	117.1	35.1	115.1	3.5	4.3
2.80		-82.0	-269.0		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-03	1.34E+03	1.47E+03	-8.499	
2	1.10E-04	1.29E+03	1.34E+03	-3.414	
3	1.40E-04	1.24E+03	1.22E+03	2.065	
4	1.77E-04	1.17E+03	1.12E+03	4.872	
5	2.20E-04	1.10E+03	1.04E+03	5.753	
6	2.80E-04	9.84E+02	9.50E+02	3.493	
7	3.55E-04	8.72E+02	8.68E+02	0.437	
8	4.43E-04	7.83E+02	7.89E+02	-0.866	
9	5.64E-04	6.81E+02	7.13E+02	-4.536	
10	7.13E-04	6.33E+02	6.50E+02	-2.631	
11	8.85E-04	5.49E+02	5.84E+02	-5.988	
12	1.10E-03	5.09E+02	5.10E+02	-0.300	
13	1.40E-03	4.48E+02	4.24E+02	5.599	
14	1.77E-03	3.74E+02	3.46E+02	8.009	
15	2.20E-03	3.14E+02	2.80E+02	12.273	
16	2.80E-03	2.40E+02	2.19E+02	9.347	
17	3.55E-03	1.82E+02	1.71E+02	6.106	
18	4.43E-03	1.37E+02	1.36E+02	0.091	
19	5.64E-03	1.07E+02	1.07E+02	-0.163	
20	7.13E-03	8.26E+01	8.41E+01	-1.773	
21	8.85E-03	6.67E+01	6.84E+01	-2.445	
22	1.10E-02	5.27E+01	5.55E+01	-5.072	
23	1.41E-02	4.32E+01	4.39E+01	-1.472	
24	1.80E-02	3.24E+01	3.53E+01	-8.650	
25	2.22E-02	2.74E+01	2.95E+01	-7.057	
26	2.85E-02	2.19E+01	2.42E+01	-9.530	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY. 26 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1W14N  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 3.71E-02, ANTILOG YIELDS 8.9059 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.88

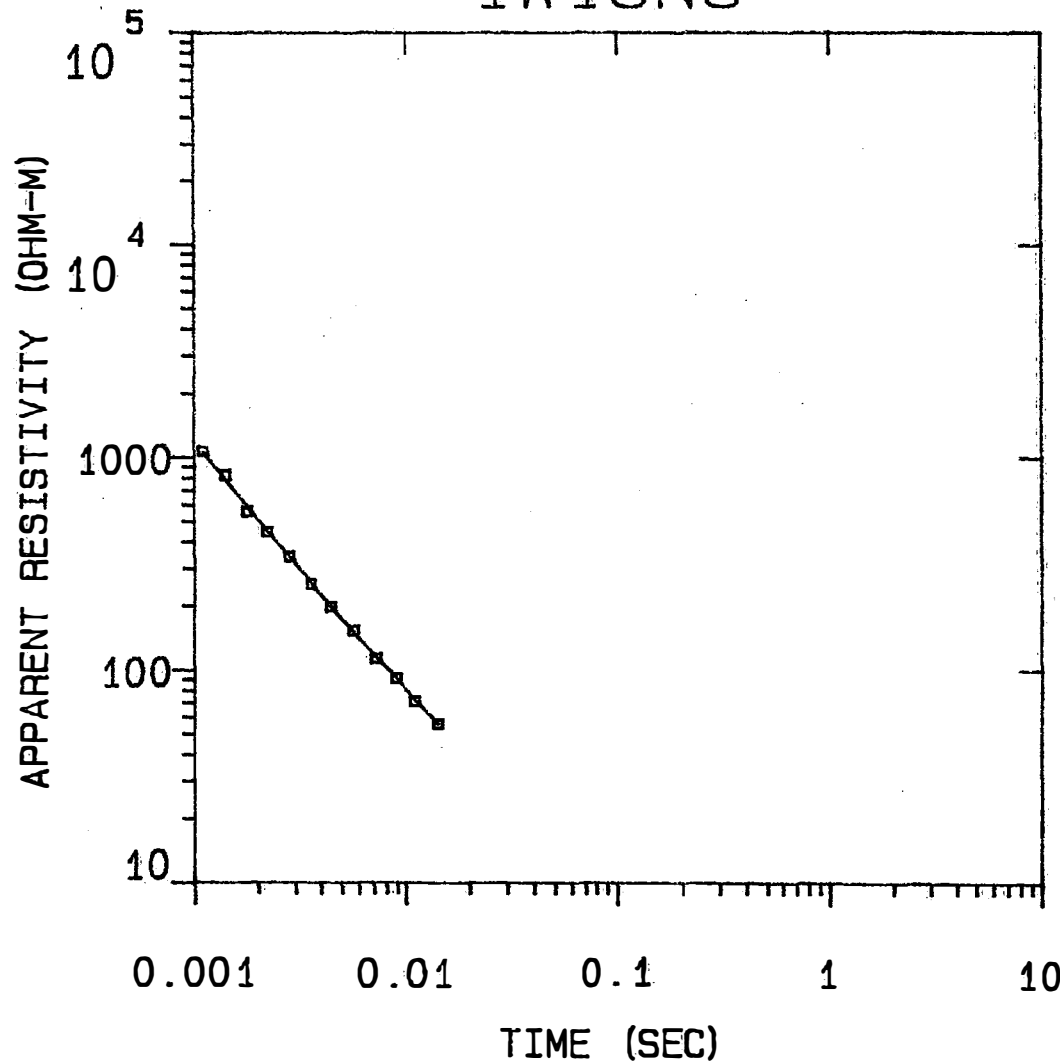
P 2 -0.01 0.10

F 3 0.00 0.00 0.00

T 1 0.01 0.10 0.00 0.95

T 2 0.01 0.00 0.00 0.00 0.99

1W15NS



MODEL:

5057.  
OHM-M

578. M

2.80  
OHM-M

% ERROR: 3.56  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W15NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (%) LAYER	CONDUCTANCE (%) TOTAL
5057.44	578.0	487.7	1600.0	0.1	0.1
2.80		-90.3	-296.2		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-03	1.07E+03	1.06E+03	1.004	
2	1.40E-03	8.24E+02	7.84E+02	5.167	
3	1.77E-03	5.58E+02	5.87E+02	-5.025	
4	2.20E-03	4.47E+02	4.50E+02	-0.728	
5	2.80E-03	3.40E+02	3.38E+02	0.764	
6	3.55E-03	2.54E+02	2.55E+02	-0.497	
7	4.43E-03	1.98E+02	1.98E+02	0.308	
8	5.64E-03	1.54E+02	1.50E+02	2.403	
9	7.13E-03	1.14E+02	1.15E+02	-1.466	
10	8.81E-03	9.17E+01	9.17E+01	-0.101	
11	1.10E-02	7.14E+01	7.27E+01	-1.694	
12	1.41E-02	5.58E+01	5.59E+01	-0.166	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY. 12 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W15NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 1.52E-02, ANTILOG YIELDS 3.5580 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

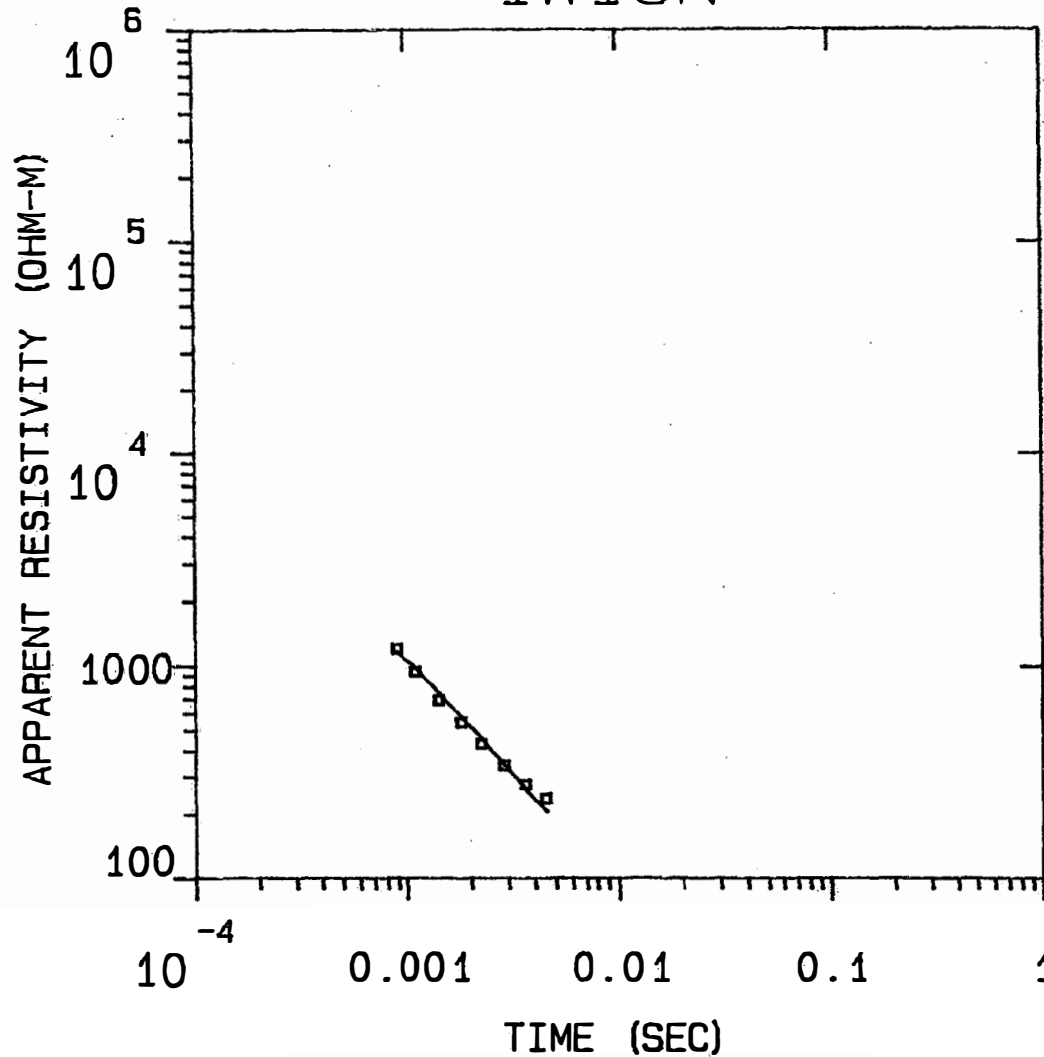
P 1 0.03

F 2 0.00 0.00

T 1 0.00 0.00 1.00

P 1 F 2 T 1

1W16N



MODEL:

604.  
OHM-M

597. M

2.80  
OHM-M

% ERROR: 10.9  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W16NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
603.65	597.0	579.1	1900.0	1.0	1.0
2.80		-17.9	-58.6		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.81E-04	1.21E+03	1.17E+03	3.801	
2	1.10E-03	9.42E+02	9.85E+02	-4.378	
3	1.41E-03	6.93E+02	7.47E+02	-7.161	
4	1.80E-03	5.45E+02	5.79E+02	-5.889	
5	2.22E-03	4.30E+02	4.54E+02	-5.302	
6	2.85E-03	3.40E+02	3.41E+02	-0.364	
7	3.60E-03	2.76E+02	2.62E+02	5.367	
8	4.49E-03	2.37E+02	2.06E+02	15.142	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 8 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W16NS  
WAIKOLOA  
1000 FT LOOP  
RMS LOG ERROR: 4.50E-02, ANTILOG YIELDS 10.9206 %  
LATE TIME PARAMETERS

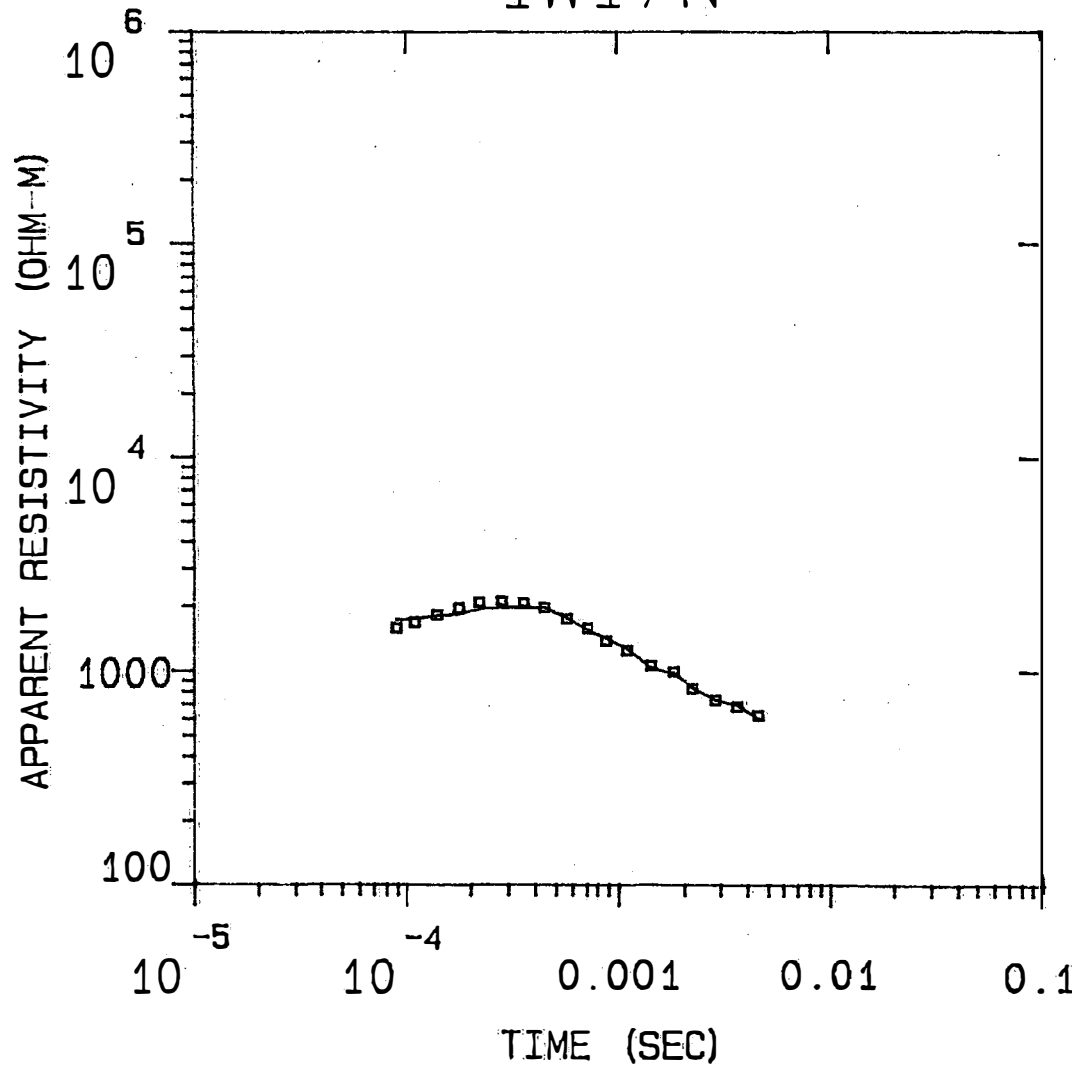
\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	1.00		
F 2	0.00	0.00	
T 1	0.00	0.00	1.00
	P 1	F 2	T 1

1W17N



MODEL:

250.  
OHM-M 63.6 M

39857.  
OHM-M 623. M

255.  
OHM-M

% ERROR: 6.16  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W17N

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
249.63	63.6	670.6	2200.0	0.3	0.3
39857.44	622.6	606.9	1991.2	0.0	0.3
254.92		-15.7	-51.4		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.58E+03	1.74E+03	-8.693	
2	1.10E-04	1.69E+03	1.76E+03	-4.128	
3	1.40E-04	1.83E+03	1.82E+03	0.761	
4	1.77E-04	1.96E+03	1.85E+03	5.971	
5	2.20E-04	2.09E+03	1.95E+03	7.093	
6	2.80E-04	2.12E+03	2.00E+03	6.020	
7	3.55E-04	2.08E+03	1.98E+03	4.936	
8	4.43E-04	1.98E+03	1.97E+03	0.466	
9	5.64E-04	1.75E+03	1.77E+03	-0.743	
10	7.13E-04	1.58E+03	1.55E+03	2.215	
11	8.81E-04	1.38E+03	1.42E+03	-2.615	
12	1.10E-03	1.25E+03	1.27E+03	-1.875	
13	1.41E-03	1.06E+03	1.03E+03	2.628	
14	1.80E-03	9.95E+02	9.74E+02	2.232	
15	2.22E-03	8.31E+02	8.42E+02	-1.384	
16	2.85E-03	7.34E+02	7.34E+02	-0.005	
17	3.60E-03	6.87E+02	6.99E+02	-1.647	
18	4.49E-03	6.25E+02	6.02E+02	3.895	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 18 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W17N  
WAIKOLOA  
1000 FT LOOP  
RMS LOG ERROR: 2.60E-02, ANTILOG YIELDS 6.1628 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

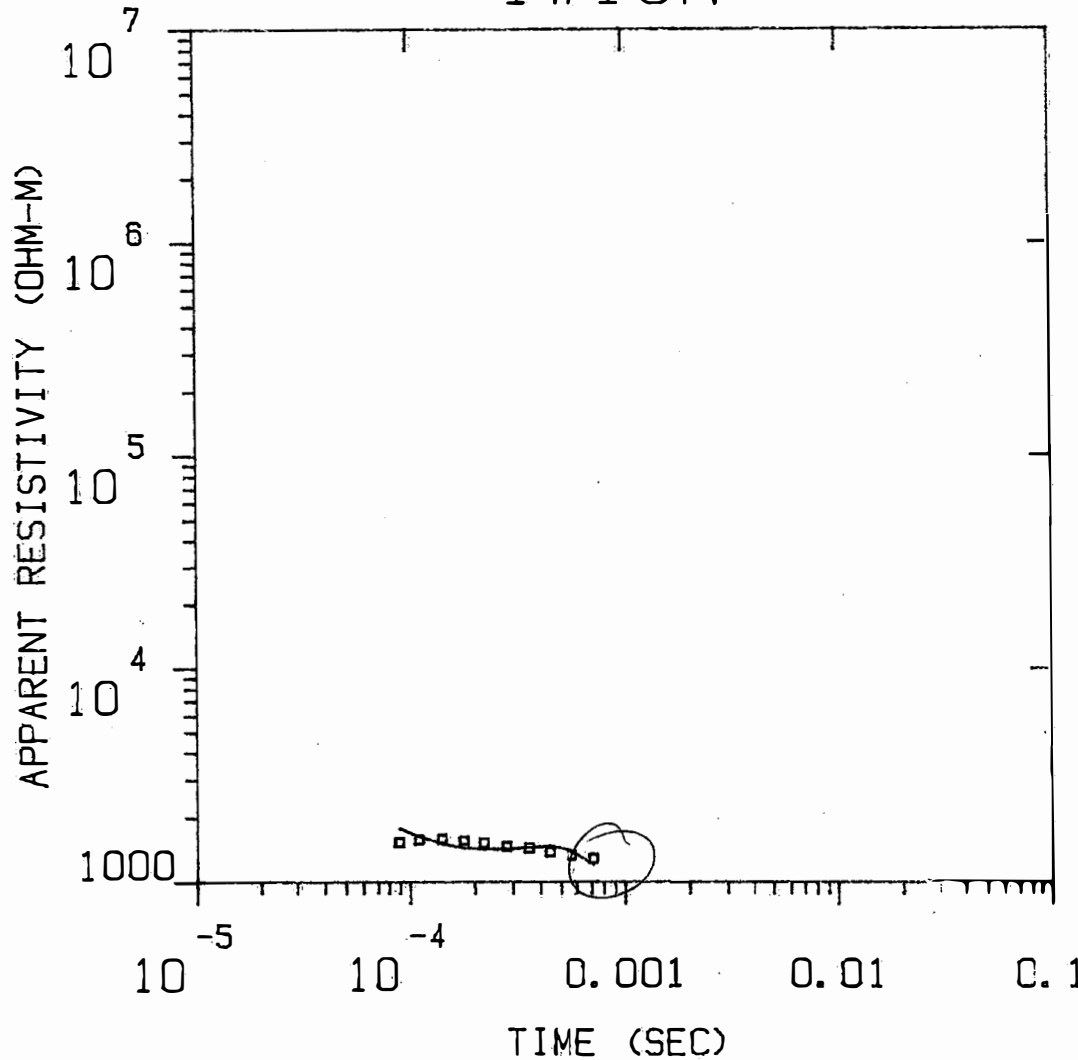
PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.10			
P 3	0.00	-0.02	0.99		
T 1	0.00	-0.04	0.00	0.99	
T 2	0.00	0.02	0.00	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

N.D.

1W18N



MODEL:

620.  
OHM-M

543. M

2.80  
OHM-M

% ERROR: 11.3  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI



1W18N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	(S) TOTAL
619.75	542.5	765.0	2510.0		
2.80		222.5	730.0	0.9	0.9

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.53E+03	1.78E+03	-14.292	
2	1.10E-04	1.57E+03	1.63E+03	-3.318	
3	1.40E-04	1.59E+03	1.51E+03	5.423	
4	1.77E-04	1.55E+03	1.44E+03	8.015	
5	2.20E-04	1.52E+03	1.42E+03	7.468	
6	2.80E-04	1.46E+03	1.42E+03	2.622	
7	3.55E-04	1.44E+03	1.46E+03	-1.443	
8	4.43E-04	1.38E+03	1.48E+03	-6.469	
9	5.64E-04	1.33E+03	1.40E+03	-4.605	
10	7.13E-04	1.29E+03	1.21E+03	6.623	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 10 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W18N  
WAIKOLOA RANCH  
1000 FOOT LOOP  
RMS LOG ERROR: 4.63E-02, ANTILOG YIELDS 11.2523 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

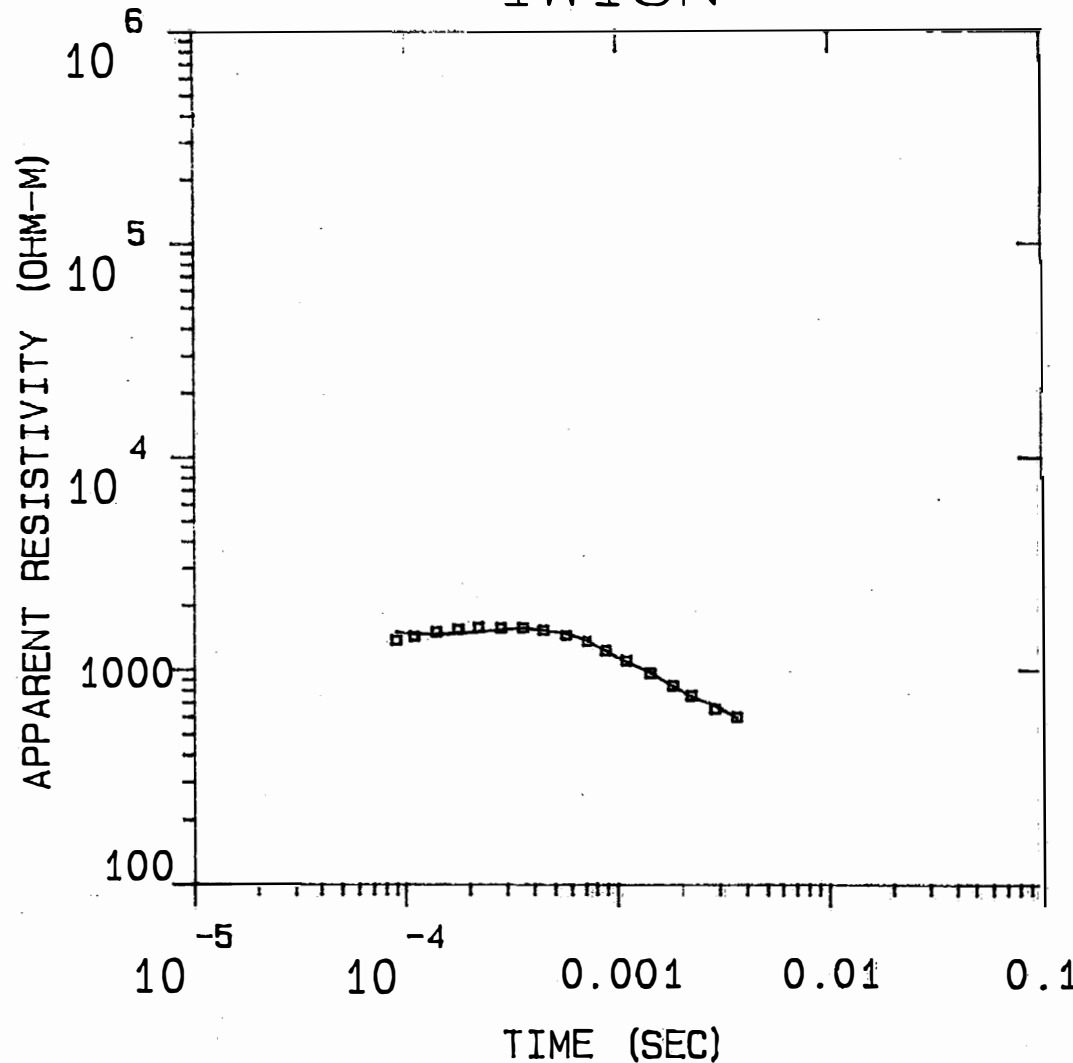
P 1 0.41

F 2 0.00 0.00

T 1 -0.16 0.00 0.14

P 1 F 2 T 1

1W19N



MODEL:

312.  
OHM-M 92.2 M

6912.  
OHM-M 592. M

220.  
OHM-M

% ERROR: 4.77  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W19N

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		560.8	1840.0		
312.39	92.2	468.6	1537.5	0.3	0.3
6911.70	592.3	-123.6	-405.7	0.1	0.4
219.97					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.38E+03	1.51E+03	-8.818	
2	1.10E-04	1.44E+03	1.48E+03	-2.260	
3	1.40E-04	1.51E+03	1.46E+03	3.042	
4	1.77E-04	1.55E+03	1.49E+03	3.681	
5	2.20E-04	1.58E+03	1.52E+03	4.252	
6	2.80E-04	1.57E+03	1.55E+03	1.213	
7	3.55E-04	1.57E+03	1.59E+03	-0.894	
8	4.43E-04	1.53E+03	1.53E+03	0.228	
9	5.64E-04	1.46E+03	1.48E+03	-1.610	
10	7.13E-04	1.36E+03	1.37E+03	-0.985	
11	8.81E-04	1.23E+03	1.22E+03	0.479	
12	1.10E-03	1.10E+03	1.08E+03	1.675	
13	1.41E-03	9.64E+02	9.73E+02	-0.844	
14	1.80E-03	8.45E+02	8.35E+02	1.214	
15	2.22E-03	7.57E+02	7.43E+02	1.843	
16	2.85E-03	6.56E+02	6.83E+02	-3.959	
17	3.60E-03	6.03E+02	5.92E+02	1.868	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 17 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W19N  
WAIKOLOA  
1000 FT LOOP  
RMS LOG ERROR: 2.02E-02, ANTILOG YIELDS 4.7691 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.96

P 2 -0.03 0.10

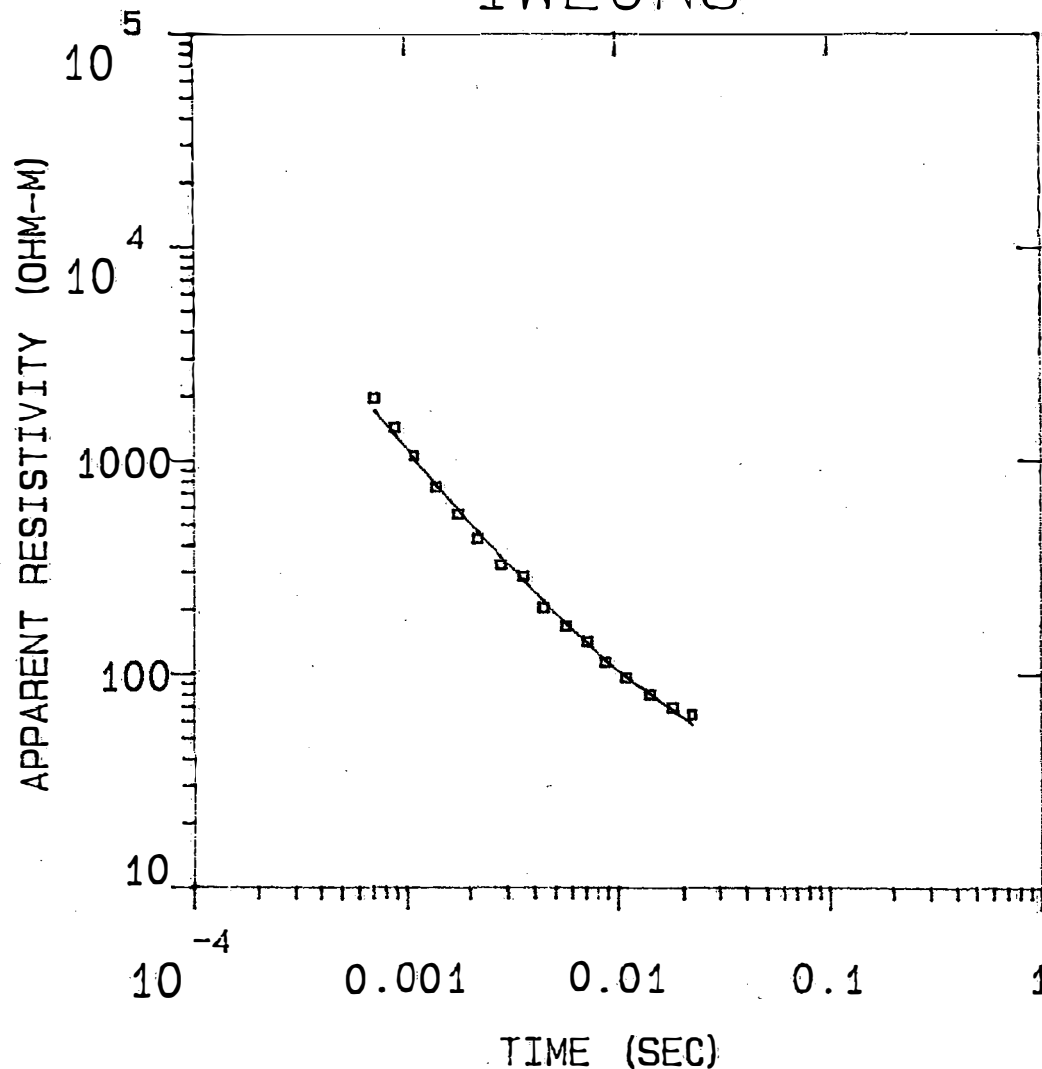
P 3 0.02 -0.05 0.91

T 1 -0.06 -0.12 0.02 0.92

T 2 0.00 0.06 0.03 0.00 0.99

P 1 P 2 P 3 T 1 T 2

1W20NS



MODEL:

2249.  
OHM-M 626. M

7.75  
OHM-M 367. M

2.80  
OHM-M

% ERROR: 9.75  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

# 1W20NS

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		506.0	1660.0		
2249.16	626.2	-120.2	-394.5	0.3	0.3
7.75	367.2	-487.4	-1599.2	47.4	47.6
2.80					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	7.13E-04	1.96E+03	1.70E+03	14.918	
2	8.85E-04	1.43E+03	1.32E+03	8.375	
3	1.10E-03	1.05E+03	1.02E+03	2.482	
4	1.41E-03	7.49E+02	7.66E+02	-2.210	
5	1.78E-03	5.61E+02	5.84E+02	-4.027	
6	2.20E-03	4.30E+02	4.62E+02	-6.934	
7	2.80E-03	3.25E+02	3.54E+02	-8.232	
8	3.55E-03	2.87E+02	2.76E+02	3.945	
9	4.43E-03	2.05E+02	2.19E+02	-6.474	
10	5.64E-03	1.68E+02	1.73E+02	-2.853	
11	7.13E-03	1.42E+02	1.40E+02	1.952	
12	8.81E-03	1.14E+02	1.16E+02	-1.697	
13	1.10E-02	9.66E+01	9.77E+01	-1.105	
14	1.41E-02	8.01E+01	8.04E+01	-0.451	
15	1.80E-02	6.97E+01	6.74E+01	3.364	
16	2.22E-02	6.47E+01	5.80E+01	11.409	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 16 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W20NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 4.04E-02, ANTILOG YIELDS 9.7484 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

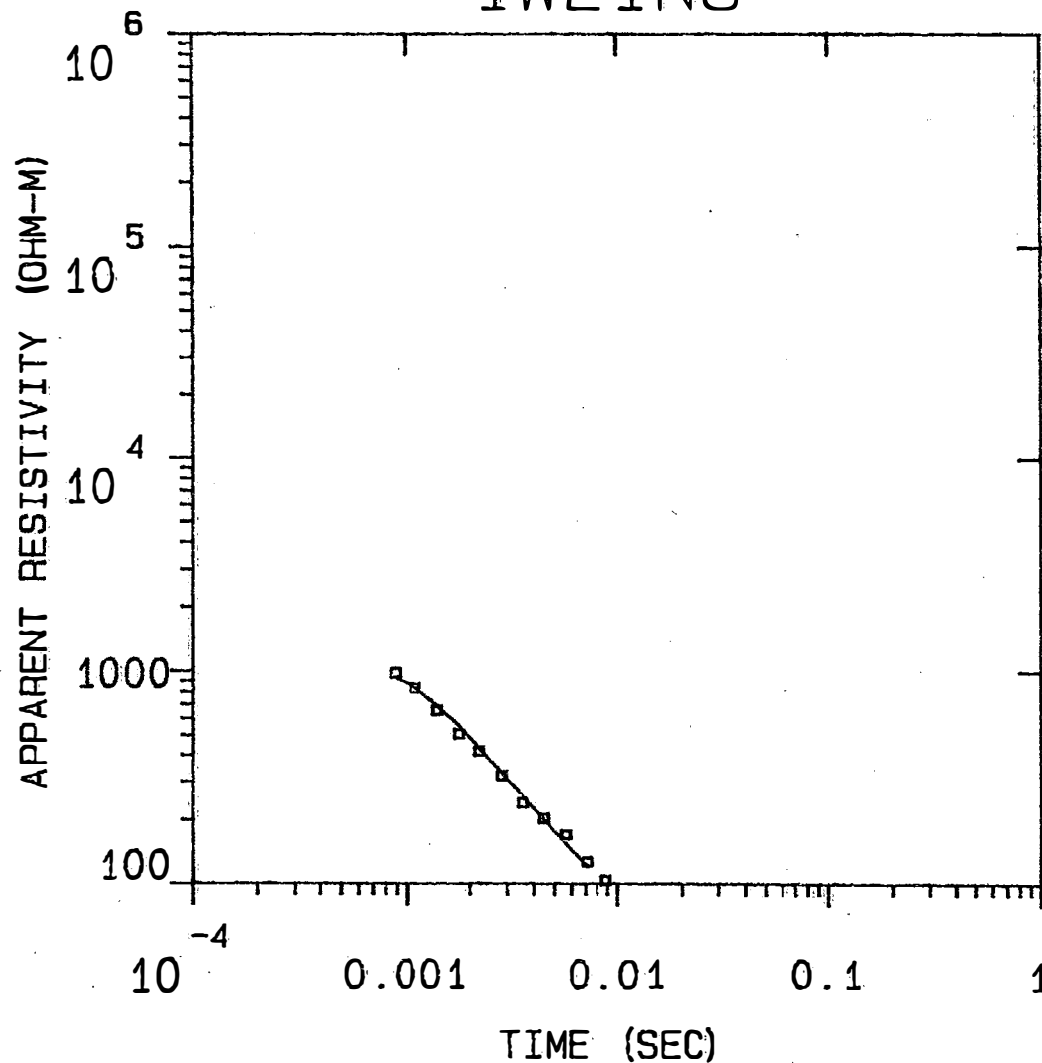
## PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	0.25				
P 2	-0.20	0.85			
F 3	0.00	0.00	0.00		
T 1	0.00	0.00	0.00	1.00	
T 2	-0.11	-0.23	0.00	-0.01	0.34
	P 1	P 2	F 3	T 1	T 2

1W21NS

MODEL:



459.  
OHM-M

586. M

2.80  
OHM-M

% ERROR: 8.88  
CALIBRATION: 1  
OFFSET: 229. M  
RAMP: 230.0  
INTERPEX: ARRTI

1W21NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
459.40	585.9	573.0	1880.0		
2.80		-12.8	-42.1	1.3	1.3

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.85E-04	9.83E+02	9.44E+02	4.197	
2	1.10E-03	8.36E+02	8.41E+02	-0.619	
3	1.41E-03	6.56E+02	6.87E+02	-4.519	
4	1.78E-03	5.08E+02	5.54E+02	-8.377	
5	2.21E-03	4.20E+02	4.34E+02	-3.185	
6	2.83E-03	3.23E+02	3.30E+02	-2.095	
7	3.55E-03	2.41E+02	2.57E+02	-6.296	
8	4.43E-03	2.03E+02	2.01E+02	1.018	
9	5.64E-03	1.70E+02	1.54E+02	10.187	
10	7.13E-03	1.27E+02	1.20E+02	5.566	
11	8.81E-03	1.04E+02	9.62E+01	7.860	

R: 229. X: 0. Y: 229. DL: 457. REA: 254. CF: 1.0000  
 TDHZ ARRAY, 11 DATA POINTS, RAMP: 230.0 MICROSEC, DATA: 1W21NS  
 WAIKOLOA  
 1500 FT LOOP  
 RMS LOG ERROR: 3.70E-02, ANTILOG YIELDS 8.8843 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.99

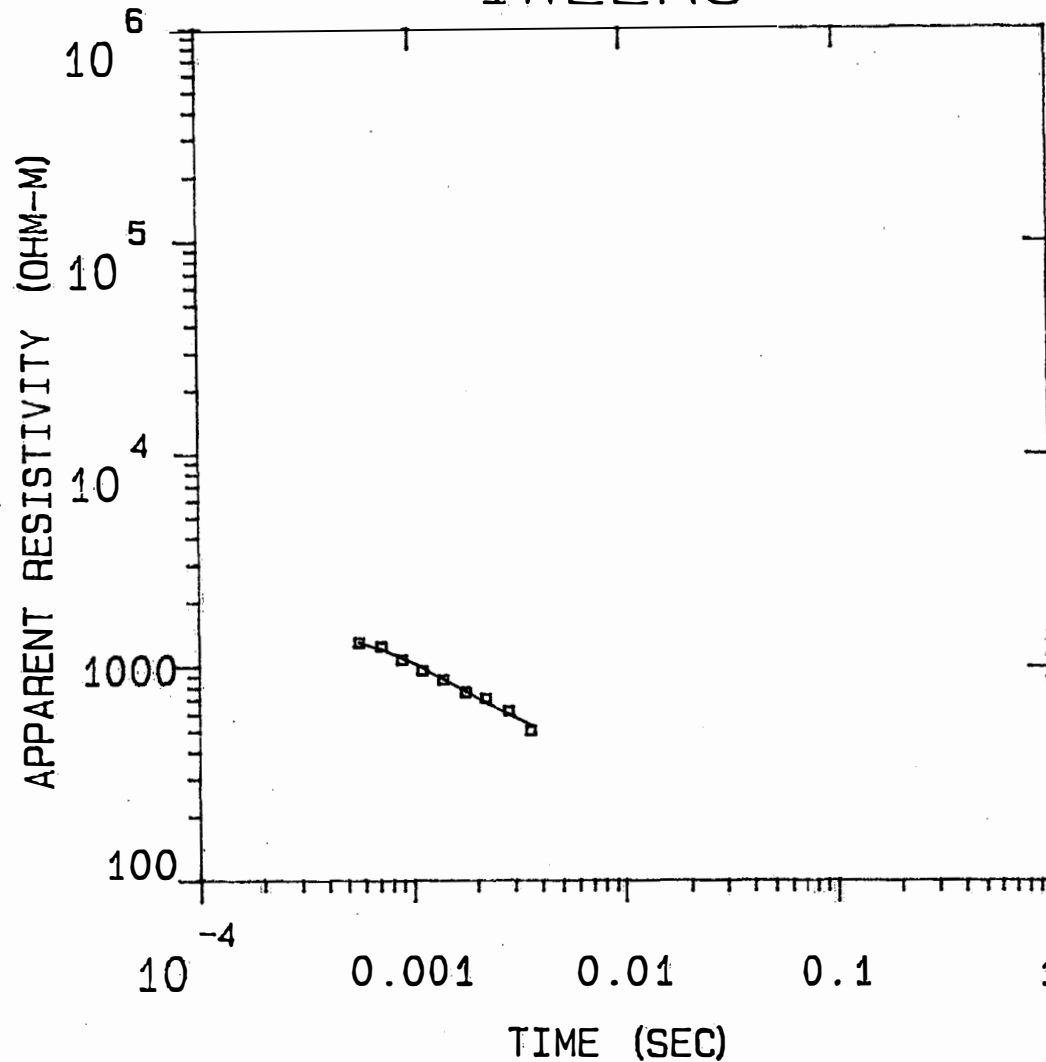
F 2 0.00 0.00

T 1 0.00 0.00 1.00

P 1 F 2 T 1

1W22NS

MODEL:



905.  
OHM-M

795. M

152.  
OHM-M

% ERROR: 4.85  
CALIBRATION: 1  
OFFSET: 229. M  
RAMP: 230.0  
INTERPEX: ARRTI



# 1W22NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
905.24	795.3	670.6	2200.0	0.9	0.9
151.71		-124.8	-409.4		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	5.64E-04	1.30E+03	1.31E+03	-0.256	
2	7.13E-04	1.25E+03	1.21E+03	3.133	
3	8.85E-04	1.09E+03	1.11E+03	-1.957	
4	1.10E-03	9.65E+02	9.95E+02	-2.985	
5	1.41E-03	8.71E+02	8.76E+02	-0.515	
6	1.78E-03	7.63E+02	7.71E+02	-1.020	
7	2.21E-03	7.15E+02	6.82E+02	4.869	
8	2.83E-03	6.22E+02	5.97E+02	4.086	
9	3.55E-03	5.06E+02	5.33E+02	-5.073	

R: 229. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000  
 TDHZ ARRAY, 9 DATA POINTS, RAMP: 230.0 MICROSEC, DATA: 1W22NS  
 WAIKOLOA  
 1500 FT LOOP  
 RMS LOG ERROR: 2.06E-02, ANTILOG YIELDS 4.8504 %  
 LATE TIME PARAMETERS

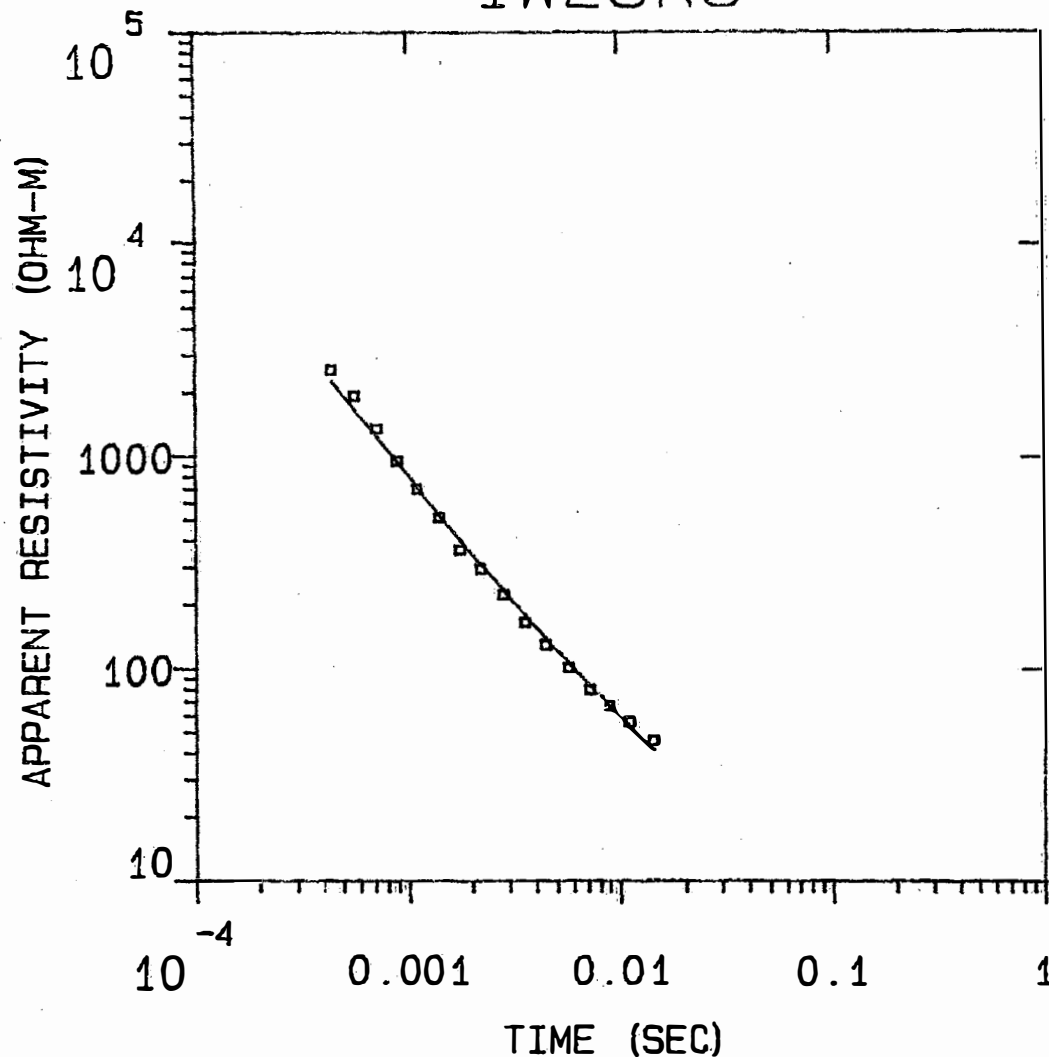
\* BLACKHAWK GEOSCIENCES, INC. \*

## PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	0.99		
P 2	-0.02	0.89	
T 1	0.01	0.03	0.99
	P 1	P 2	T 1

1W23NS



MODEL:

5353.  
OHM-M

488. M

2.80  
OHM-M

% ERROR: 11.7  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W2SNS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
5353.07	488.0	393.2	1290.0	0.1	0.1
2.80		-94.8	-311.0		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	2.56E+03	2.28E+03	12.527	
2	5.64E-04	1.93E+03	1.86E+03	15.997	
3	7.13E-04	1.35E+03	1.23E+03	9.803	
4	8.85E-04	9.45E+02	9.36E+02	0.930	
5	1.10E-03	6.96E+02	7.15E+02	-2.627	
6	1.41E-03	5.14E+02	5.28E+02	-2.786	
7	1.77E-03	3.63E+02	3.99E+02	-9.120	
8	2.20E-03	2.93E+02	3.08E+02	-4.841	
9	2.80E-03	2.22E+02	2.33E+02	-4.407	
10	3.55E-03	1.64E+02	1.77E+02	-7.038	
11	4.43E-03	1.29E+02	1.38E+02	-6.536	
12	5.64E-03	1.01E+02	1.06E+02	-4.578	
13	7.13E-03	7.94E+01	8.24E+01	-3.631	
14	8.81E-03	6.66E+01	6.62E+01	0.620	
15	1.10E-02	5.61E+01	5.30E+01	5.799	
16	1.41E-02	4.39E+01	4.14E+01	10.949	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 16 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W2SNS  
WAIKOLOA

1000 FT LOOP

RMS LOG ERROR: 4.81E-02, ANTILOG YIELDS 11.7241 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

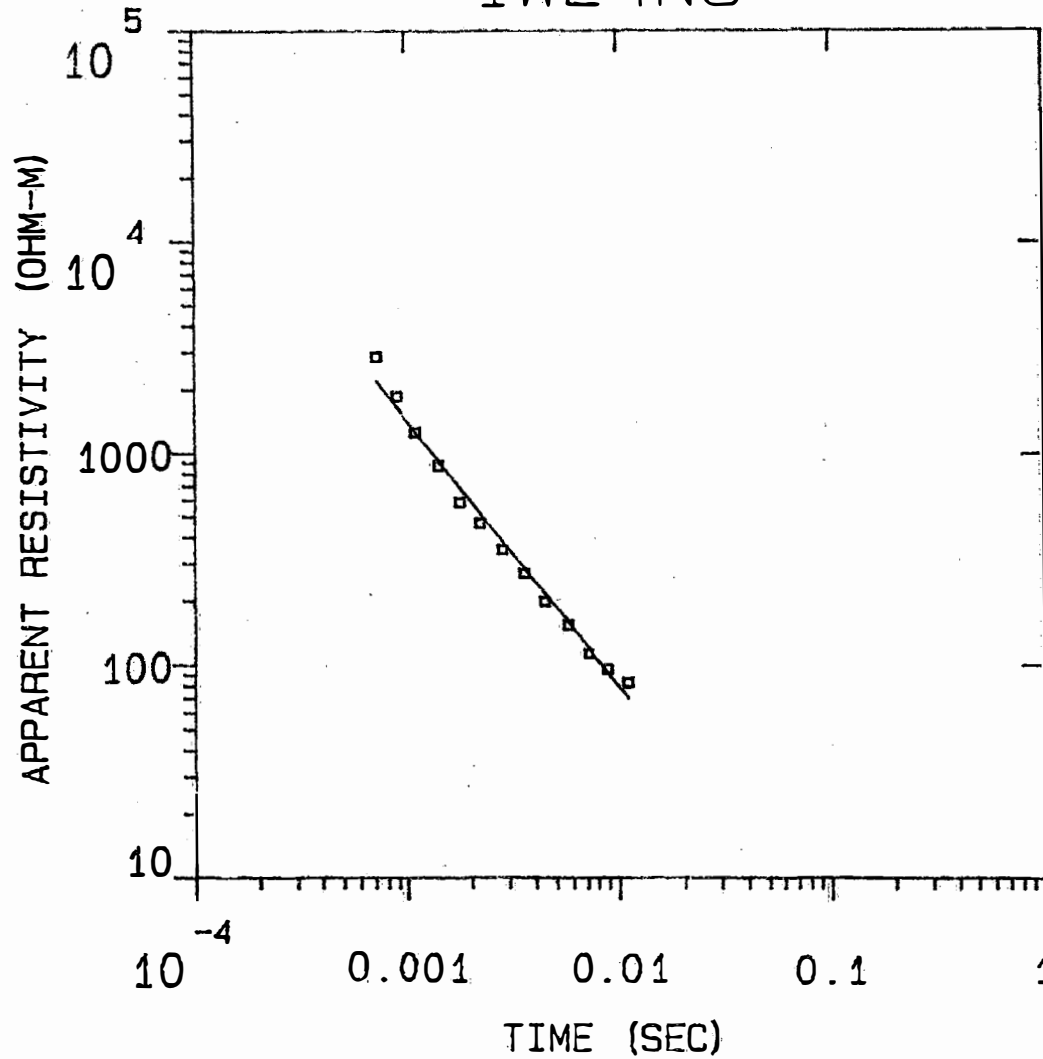
P 1 0.99

F 2 0.00 0.00

T 1 0.00 0.00 1.00

P 1 F 2 T 1

1W24NS



MODEL:

14706.  
OHM-M

630. M

2.80  
OHM-M

% ERROR: 18.3  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W24NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	TOTAL
14705.86	629.6	516.6	1695.0	0.0	0.0
2.80		-112.9	-370.5		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	7.13E-04	2.87E+03	2.20E+03	30.083	
2	8.85E-04	1.36E+03	1.66E+03	12.096	
3	1.10E-03	1.25E+03	1.25E+03	-0.067	
4	1.41E-03	8.72E+02	9.13E+02	-4.447	
5	1.77E-03	5.86E+02	6.80E+02	-13.848	
6	2.20E-03	4.65E+02	5.14E+02	-9.529	
7	2.80E-03	3.48E+02	3.79E+02	-8.065	
8	3.55E-03	2.69E+02	2.82E+02	-4.675	
9	4.43E-03	1.98E+02	2.15E+02	-7.622	
10	5.64E-03	1.54E+02	1.59E+02	-3.600	
11	7.13E-03	1.14E+02	1.19E+02	-4.286	
12	8.81E-03	9.62E+01	9.17E+01	4.952	
13	1.10E-02	8.27E+01	7.04E+01	17.577	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 13 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W24NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 7.32E-02, ANTILOG YIELDS 18.3494 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.05

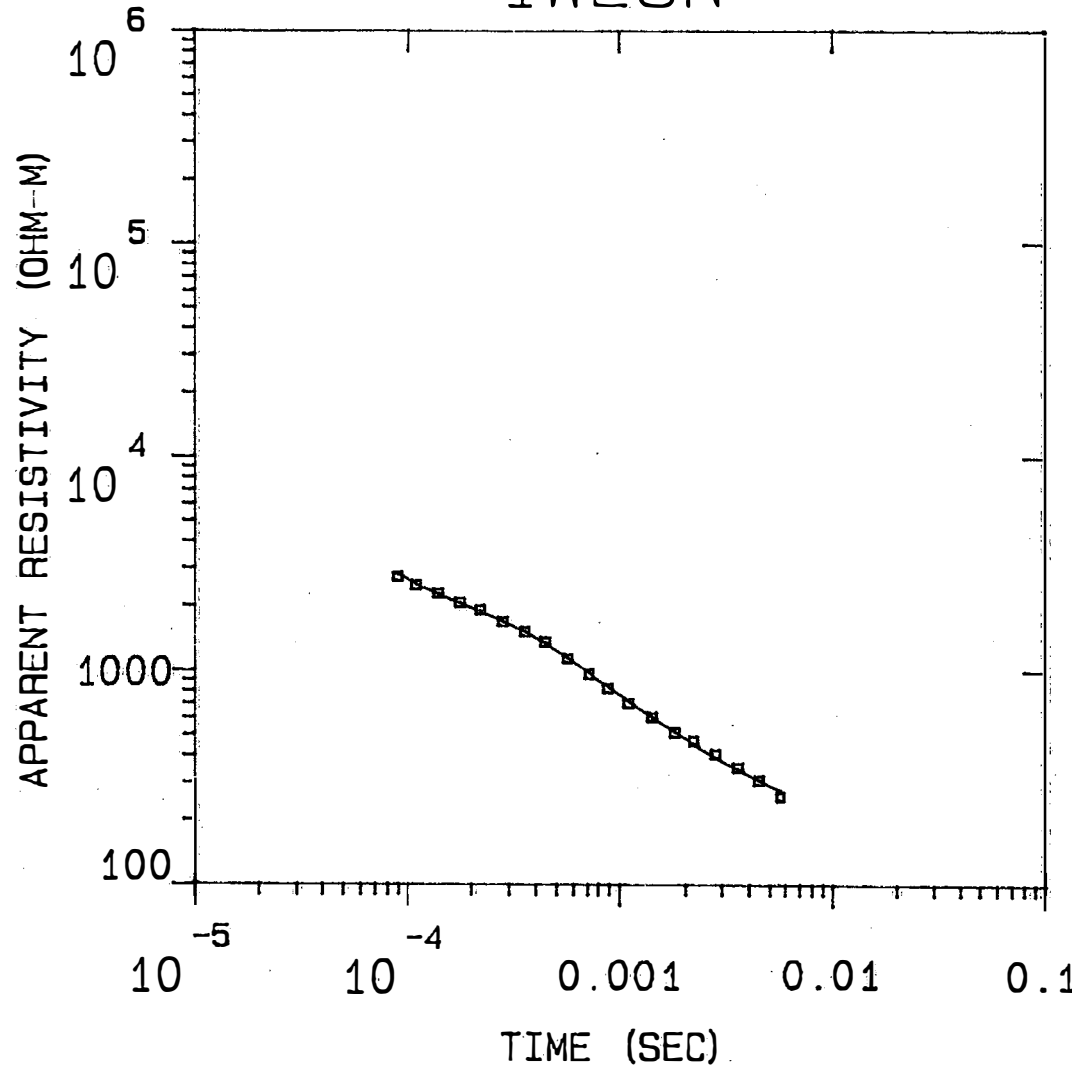
F 2 0.00 0.00

T 1 0.00 0.00 1.00

P 1 F 2 T 1

1W25N

MODEL:



900.  
OHM-M

582. M

97.6  
OHM-M

% ERROR: 3.48  
CALIBRATION: 1  
OFFSET: 229. M  
RAMP: 235.0  
INTERPEX: ARRTI

1W25N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
899.98	582.5	670.6	2200.0	0.6	0.6
97.63		88.1	289.1		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.72E+03	2.81E+03	-2.955	
2	1.10E-04	2.48E+03	2.52E+03	-1.313	
3	1.40E-04	2.28E+03	2.25E+03	1.180	
4	1.77E-04	2.07E+03	2.04E+03	1.259	
5	2.20E-04	1.91E+03	1.87E+03	1.992	
6	2.80E-04	1.69E+03	1.69E+03	-0.184	
7	3.55E-04	1.52E+03	1.51E+03	0.402	
8	4.43E-04	1.36E+03	1.34E+03	1.434	
9	5.64E-04	1.14E+03	1.14E+03	-0.449	
10	7.13E-04	9.61E+02	9.75E+02	-1.456	
11	8.85E-04	8.25E+02	8.40E+02	-1.832	
12	1.10E-03	7.02E+02	7.20E+02	-2.397	
13	1.41E-03	6.05E+02	6.04E+02	0.125	
14	1.78E-03	5.14E+02	5.18E+02	-0.827	
15	2.21E-03	4.71E+02	4.52E+02	4.063	
16	2.80E-03	4.08E+02	3.91E+02	4.290	
17	3.55E-03	3.53E+02	3.45E+02	2.327	
18	4.43E-03	3.07E+02	3.07E+02	0.043	
19	5.64E-03	2.59E+02	2.73E+02	-5.162	

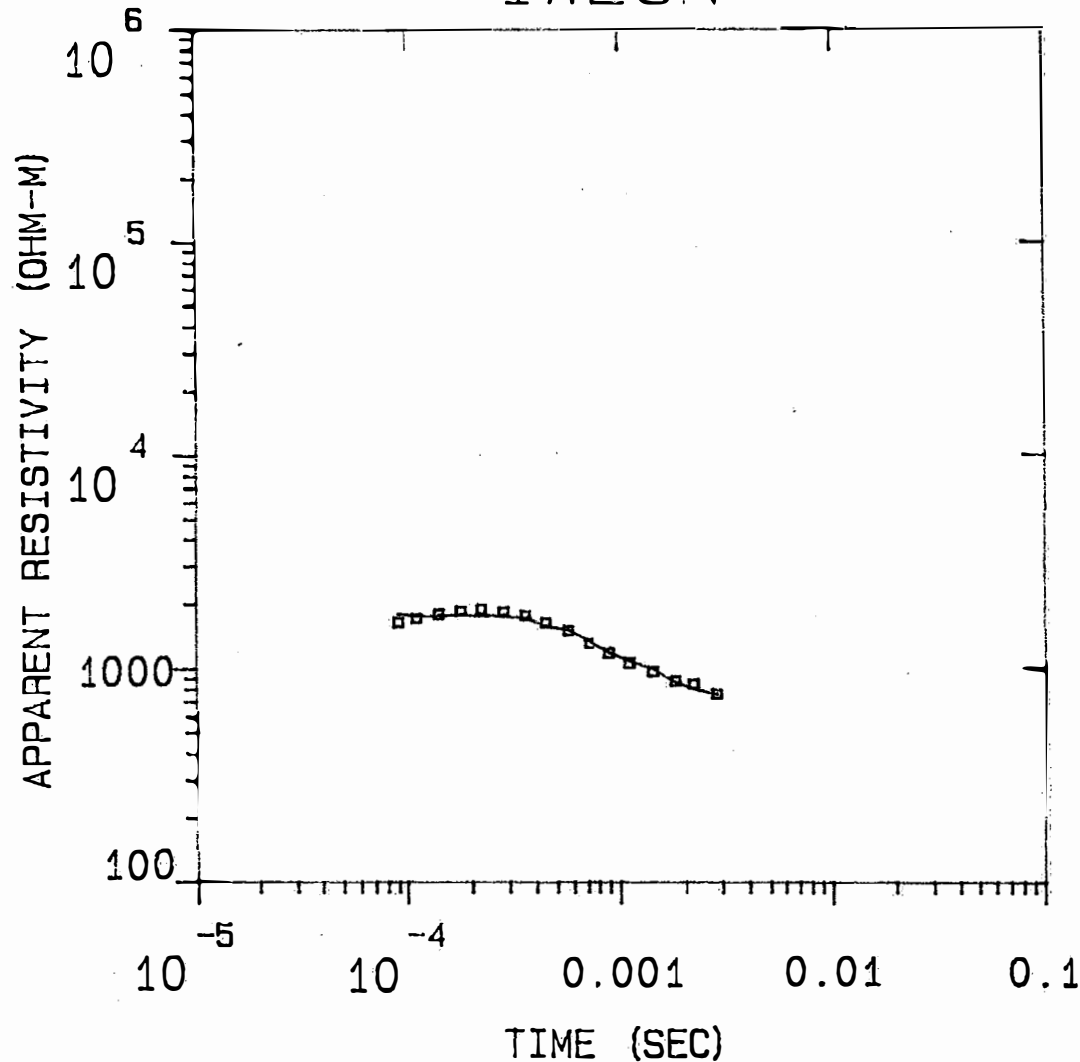
R: 229. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000  
TDHZ ARRAY, 19 DATA POINTS, RAMP: 235.0 MICROSEC, DATA: 1W25N  
WAIKOLOA  
1500 FT LOOP  
RMS LOG ERROR: 1.49E-02, ANTILOG YIELDS 3.4840 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

1W26N



MODEL:

238.  
OHM-M 64.6 M

28461.  
OHM-M 506. M

348.  
OHM-M

% ERROR: 6.06  
CALIBRATION: 1  
OFFSET: 229. M  
RAMP: 235.0  
INTERPEX: ARRTI



1W26N

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
237.68	64.6	707.1	2320.0	0.3	0.3
28460.66	506.3	642.5	2108.1	0.0	0.3
348.33		136.2	446.9		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.65E+03	1.81E+03	-8.681	
2	1.10E-04	1.71E+03	1.76E+03	-2.521	
3	1.40E-04	1.80E+03	1.76E+03	2.450	
4	1.77E-04	1.86E+03	1.79E+03	3.842	
5	2.20E-04	1.89E+03	1.76E+03	7.293	
6	2.80E-04	1.84E+03	1.77E+03	3.814	
7	3.55E-04	1.77E+03	1.72E+03	2.900	
8	4.43E-04	1.64E+03	1.57E+03	4.178	
9	5.64E-04	1.50E+03	1.52E+03	-0.879	
10	7.13E-04	1.32E+03	1.34E+03	-1.764	
11	8.85E-04	1.18E+03	1.19E+03	-0.699	
12	1.10E-03	1.06E+03	1.08E+03	-1.838	
13	1.41E-03	9.70E+02	1.00E+03	-3.153	
14	1.78E-03	8.74E+02	8.62E+02	1.397	
15	2.21E-03	8.49E+02	8.05E+02	5.487	
16	2.83E-03	7.62E+02	7.58E+02	0.615	

R: 229. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000  
TDHZ ARRAY, 16 DATA POINTS, RAMP: 235.0 MICROSEC, DATA: 1W26N  
WAIKOLOA  
1500 FT LOOP  
RMS LOG ERROR: 2.56E-02, ANTILOG YIELDS 6.0648 %  
LATE TIME PARAMETERS

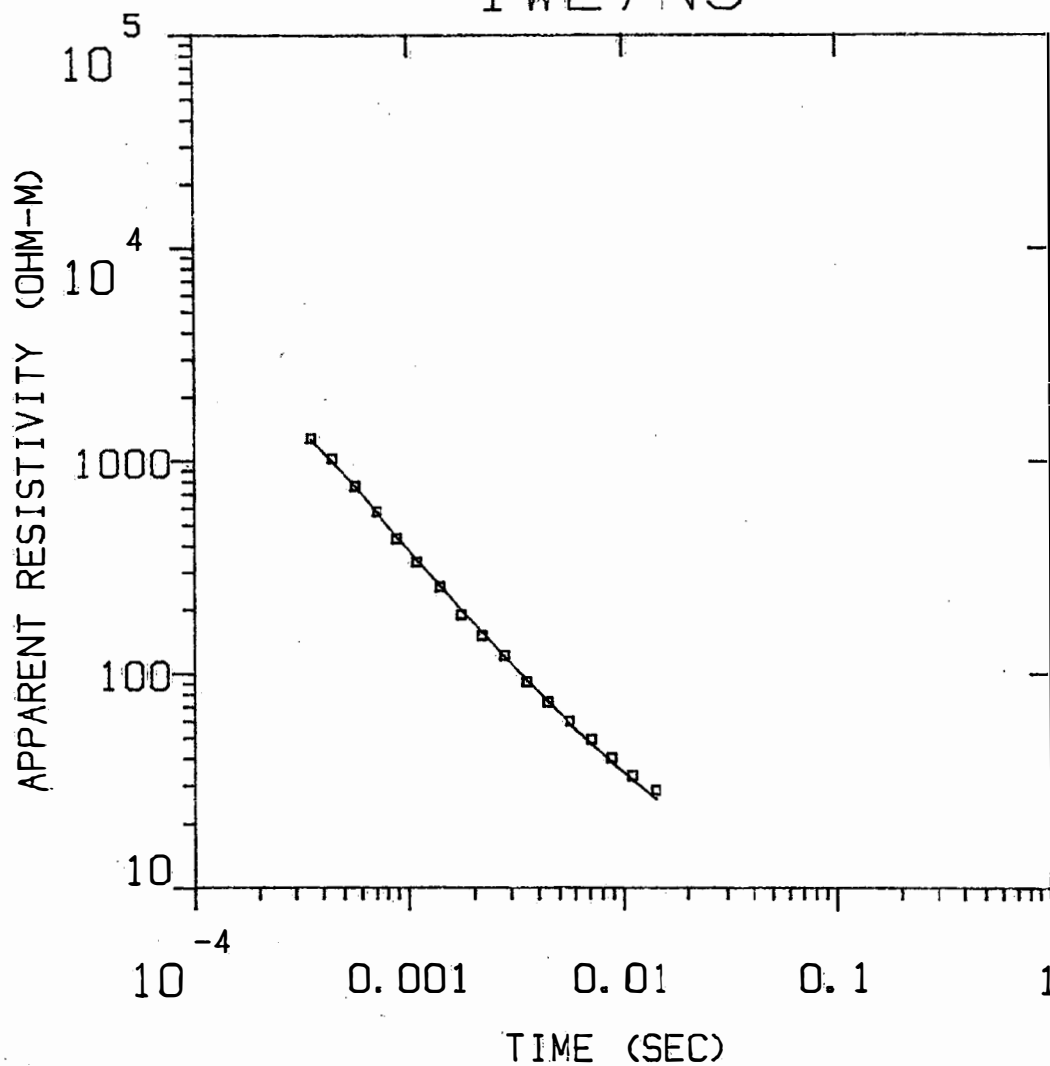
\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	-0.01	0.07			
P 3	0.00	-0.02	0.99		
T 1	0.00	-0.04	0.00	0.99	
T 2	0.00	0.04	0.01	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

1W27NS



MODEL:

626.  
OHM-M

360. M

2.80  
OHM-M

% ERROR: 5.72  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 205.0  
INTERPEX: ARRTI

1W27NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE LAYER	(S) TOTAL
626.43	360.4	320.0	1050.0		
2.80		-40.4	-132.4	0.6	0.6

	TIMES	DATA	CALC	% ERROR	STD ERR
1	3.55E-04	1.27E+03	1.27E+03	0.529	
2	4.43E-04	1.02E+03	9.99E+02	2.498	
3	5.64E-04	7.60E+02	7.62E+02	-0.284	
4	7.13E-04	5.78E+02	5.74E+02	0.761	
5	8.85E-04	4.30E+02	4.44E+02	-2.977	
6	1.10E-03	3.35E+02	3.46E+02	-3.184	
7	1.41E-03	2.55E+02	2.60E+02	-1.854	
8	1.77E-03	1.88E+02	2.00E+02	-5.659	
9	2.20E-03	1.51E+02	1.57E+02	-4.209	
10	2.80E-03	1.21E+02	1.21E+02	0.445	
11	3.55E-03	9.14E+01	9.39E+01	-2.579	
12	4.43E-03	7.36E+01	7.48E+01	-1.693	
13	5.64E-03	5.99E+01	5.87E+01	2.050	
14	7.13E-03	4.91E+01	4.70E+01	4.419	
15	8.81E-03	4.01E+01	3.87E+01	3.795	
16	1.10E-02	3.32E+01	3.19E+01	4.169	
17	1.41E-02	2.84E+01	2.59E+01	9.850	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 17 DATA POINTS, RAMP: 205.0 MICROSEC, DATA: 1W27NS  
WAIKOLOA  
1000 FT LOOP  
RMS LOG ERROR: 2.42E-02, ANTILOG YIELDS 5.7244 %  
LATE TIME PARAMETERS

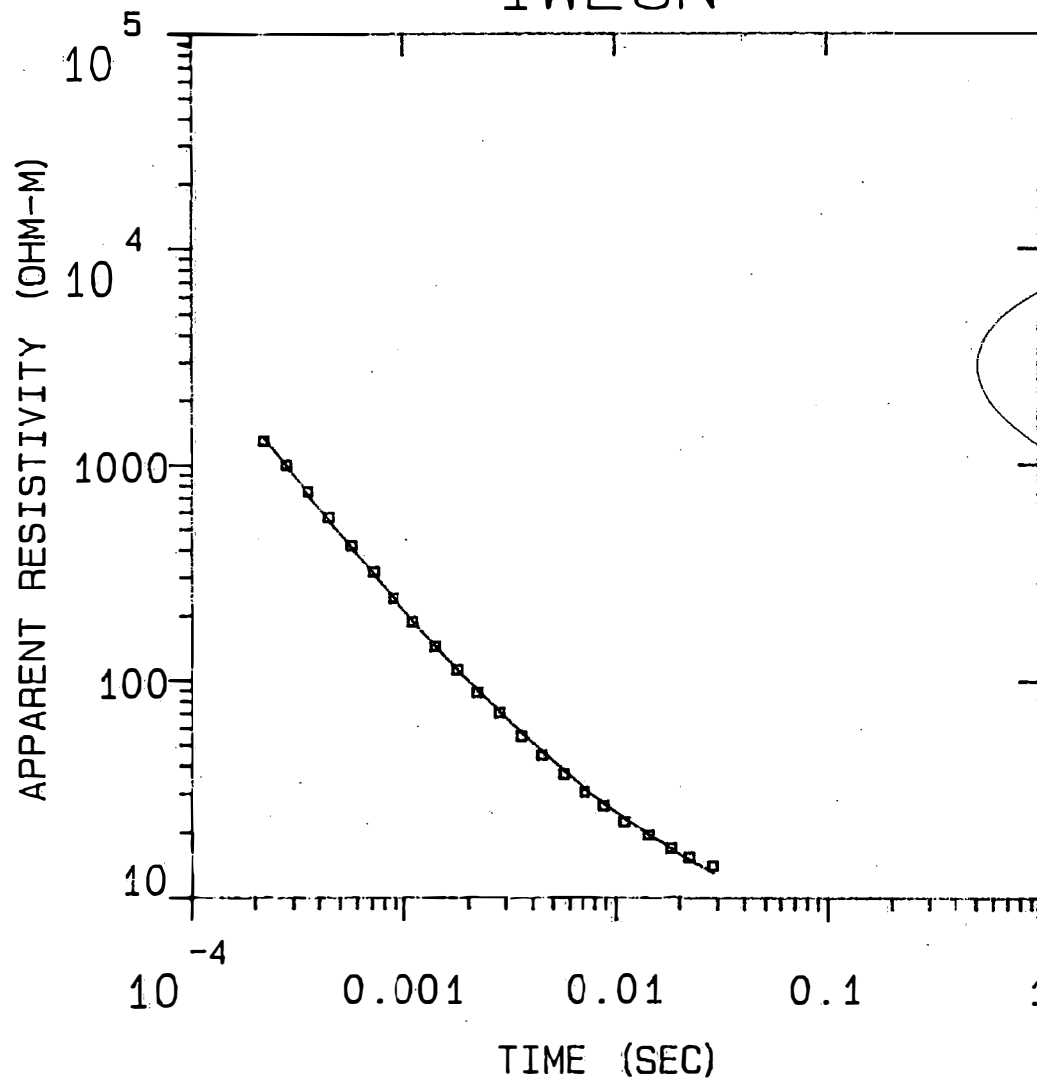
\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
"F" MEANS FIXED PARAMETER

P 1 1.00  
F 2 0.00 0.00  
T 1 0.00 0.00 1.00  
P 1 F 2 T 1

1W28N

MODEL:



1643.  
OHM-M

271. M

4.15  
OHM-M

% ERROR: 4.37  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 200.0  
INTERPEX: ARRTI

1W28NS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE LAYER	(S) TOTAL
438.58	279.5	225.6	740.0	0.6	0.6
2.80		-54.0	-177.2		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.80E-04	9.93E+02	9.49E+02	4.585	
2	3.55E-04	7.46E+02	7.41E+02	0.757	
3	4.43E-04	5.67E+02	5.79E+02	-2.094	
4	5.64E-04	4.21E+02	4.33E+02	-2.971	
5	7.13E-04	3.19E+02	3.30E+02	-3.288	
6	8.85E-04	2.42E+02	2.58E+02	-6.059	
7	1.10E-03	1.88E+02	2.02E+02	-6.539	
8	1.41E-03	1.45E+02	1.53E+02	-5.167	
9	1.78E-03	1.13E+02	1.18E+02	-4.373	
10	2.20E-03	8.87E+01	9.43E+01	-5.922	
11	2.80E-03	7.11E+01	7.34E+01	-3.138	
12	3.55E-03	5.54E+01	5.80E+01	-4.525	
13	4.43E-03	4.53E+01	4.68E+01	-3.125	
14	5.64E-03	3.70E+01	3.75E+01	-1.466	
15	7.13E-03	3.07E+01	3.05E+01	0.730	
16	8.81E-03	2.65E+01	2.55E+01	3.771	
17	1.10E-02	2.25E+01	2.15E+01	4.444	
18	1.41E-02	1.95E+01	1.78E+01	10.099	
19	1.80E-02	1.70E+01	1.51E+01	13.002	
20	2.22E-02	1.54E+01	1.31E+01	17.779	
21	2.85E-02	1.41E+01	1.12E+01	25.269	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 21 DATA POINTS, RAMP: 200.0 MICROSEC, DATA: 1W28NS  
 WAIKOLOA  
 1000 FT LOOP  
 RMS LOG ERROR: 5.15E-02, ANTILOG YIELDS 12.5772 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

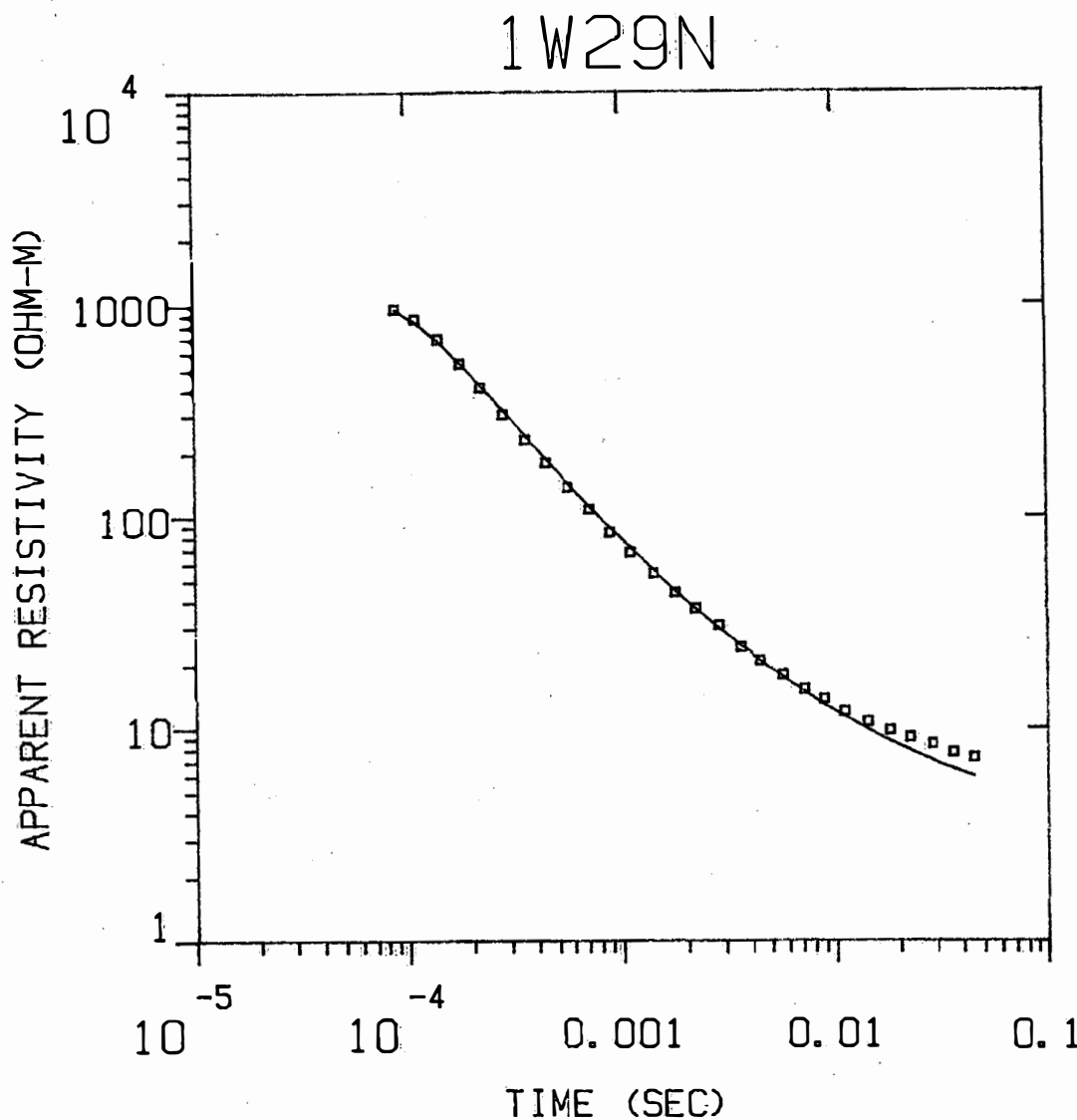
"F" MEANS FIXED PARAMETER

P 1 1.00

F 2 0.00 0.00

T 1 0.00 0.00 1.00

P 1 F 2 T 1



MODEL:

322.  
OHM-M 176. M

2.80  
OHM-M

% ERROR: 12.6  
CALIBRATION: 1  
OFFSET: 76.2 M  
RAMP: 105.0  
INTERPEX: ARRTI

1W29N

MODEL: 2 LAYERS

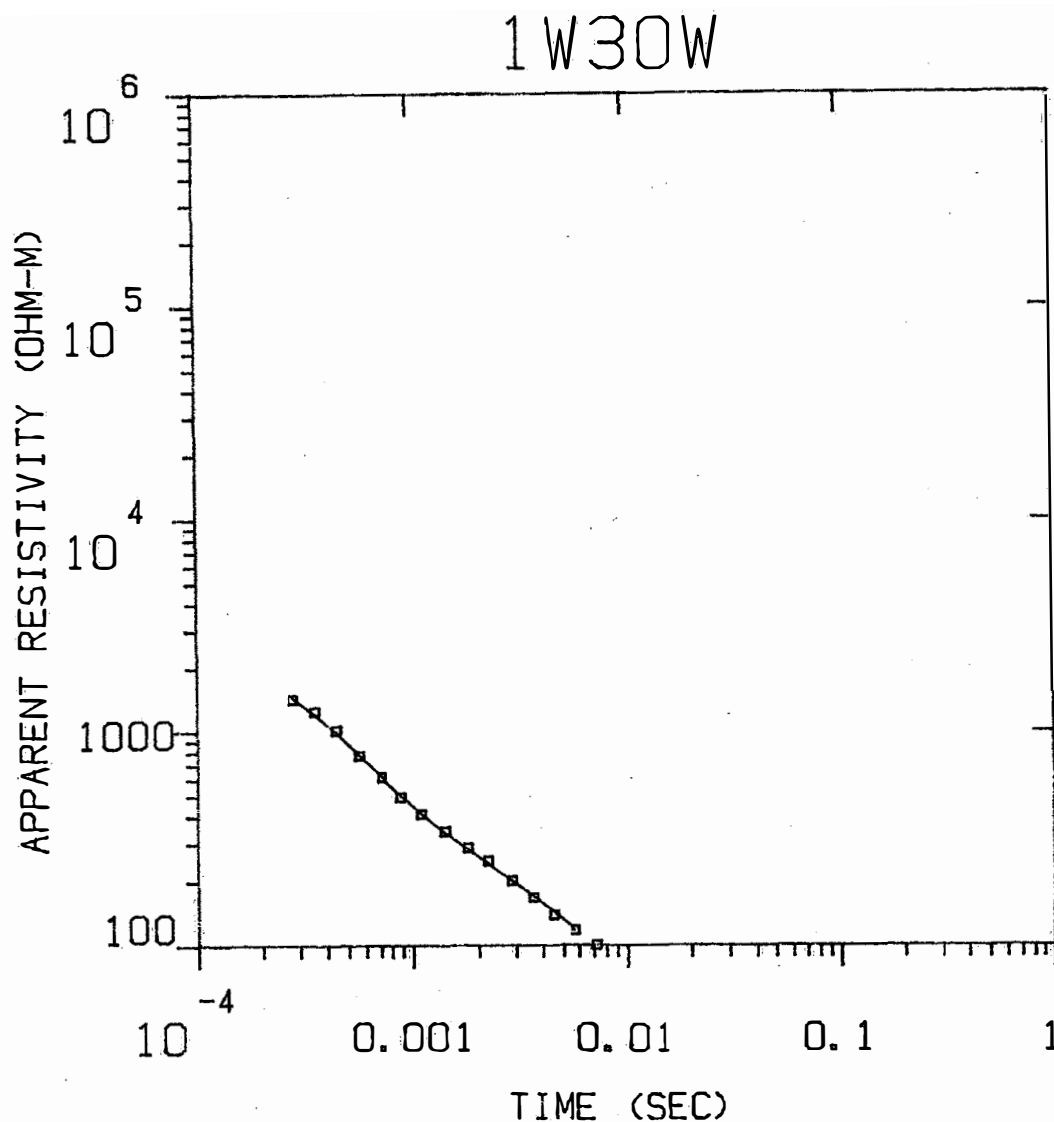
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE LAYER	CONDUCTANCE TOTAL
322.44	175.9	143.3	470.0		
2.80		-32.6	-107.1	0.5	0.5

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	9.45E+02	9.42E+02	0.316	
2	1.10E-04	8.51E+02	8.26E+02	3.053	
3	1.40E-04	6.84E+02	6.75E+02	1.363	
4	1.77E-04	5.22E+02	5.29E+02	-1.336	
5	2.20E-04	4.03E+02	4.18E+02	-3.519	
6	2.80E-04	3.02E+02	3.19E+02	-5.472	
7	3.55E-04	2.30E+02	2.42E+02	-5.092	
8	4.43E-04	1.80E+02	1.89E+02	-4.747	
9	5.64E-04	1.37E+02	1.45E+02	-5.269	
10	7.13E-04	1.08E+02	1.12E+02	-4.046	
11	8.85E-04	8.39E+01	8.94E+01	-6.090	
12	1.10E-03	6.76E+01	7.19E+01	-6.052	
13	1.41E-03	5.38E+01	5.62E+01	-4.186	
14	1.78E-03	4.37E+01	4.49E+01	-2.550	
15	2.21E-03	3.67E+01	3.69E+01	-0.479	
16	2.83E-03	3.04E+01	2.97E+01	2.259	
17	3.55E-03	2.41E+01	2.47E+01	-2.297	
18	4.43E-03	2.07E+01	2.07E+01	-0.124	
19	5.64E-03	1.77E+01	1.74E+01	2.005	
20	7.13E-03	1.52E+01	1.48E+01	2.464	
21	8.81E-03	1.36E+01	1.29E+01	5.739	
22	1.10E-02	1.19E+01	1.13E+01	4.892	
23	1.41E-02	1.06E+01	9.82E+00	8.286	
24	1.80E-02	9.72E+00	8.68E+00	11.979	
25	2.22E-02	9.00E+00	7.87E+00	14.396	
26	2.85E-02	8.42E+00	7.03E+00	19.721	
27	3.60E-02	7.68E+00	6.44E+00	19.243	
28	4.49E-02	7.27E+00	5.93E+00	22.603	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000  
 TDHZ ARRAY, 28 DATA POINTS, RAMP: 105.0 MICROSEC, DATA: 1W29N  
 WAIKOLOA  
 500 FT LOOP  
 RMS LOG ERROR: 5.16E-02, ANTILOG YIELDS 12.6047 %  
 LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
 "F" MEANS FIXED PARAMETER  
 P 1 1.00



MODEL:

715.  
OHM-M 422. M

14.7  
OHM-M 176. M

2.80  
OHM-M

% ERROR: 3.23  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 210.0  
INTERPEX: ARRTI



1W30W

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
715.08	421.7	371.9	1220.0	0.6	0.6
14.68	176.3	-49.9	-163.6	12.0	12.6
2.80		-226.2	-742.0		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.80E-04	1.42E+03	1.45E+03	-2.104	
2	3.55E-04	1.24E+03	1.21E+03	2.749	
3	4.43E-04	1.01E+03	9.92E+02	2.063	
4	5.64E-04	7.71E+02	7.78E+02	-0.976	
5	7.13E-04	6.10E+02	6.15E+02	-0.945	
6	8.81E-04	4.92E+02	5.05E+02	-2.444	
7	1.10E-03	4.10E+02	4.14E+02	-1.152	
8	1.41E-03	3.41E+02	3.35E+02	1.620	
9	1.80E-03	2.85E+02	2.81E+02	1.549	
10	2.22E-03	2.48E+02	2.41E+02	2.850	
11	2.85E-03	2.00E+02	2.01E+02	-0.342	
12	3.60E-03	1.67E+02	1.71E+02	-2.239	
13	4.49E-03	1.39E+02	1.44E+02	-3.456	
14	5.70E-03	1.17E+02	1.18E+02	-0.406	
15	7.19E-03	1.00E+02	9.67E+01	3.459	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
 TDHZ ARRAY, 15 DATA POINTS, RAMP: 210.0 MICROSEC, DATA: 1W30W  
 SOUNDING 30

RMS LOG ERROR: 1.38E-02, ANTILOG YIELDS  
 LATE TIME PARAMETERS

3.2349 %

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.95

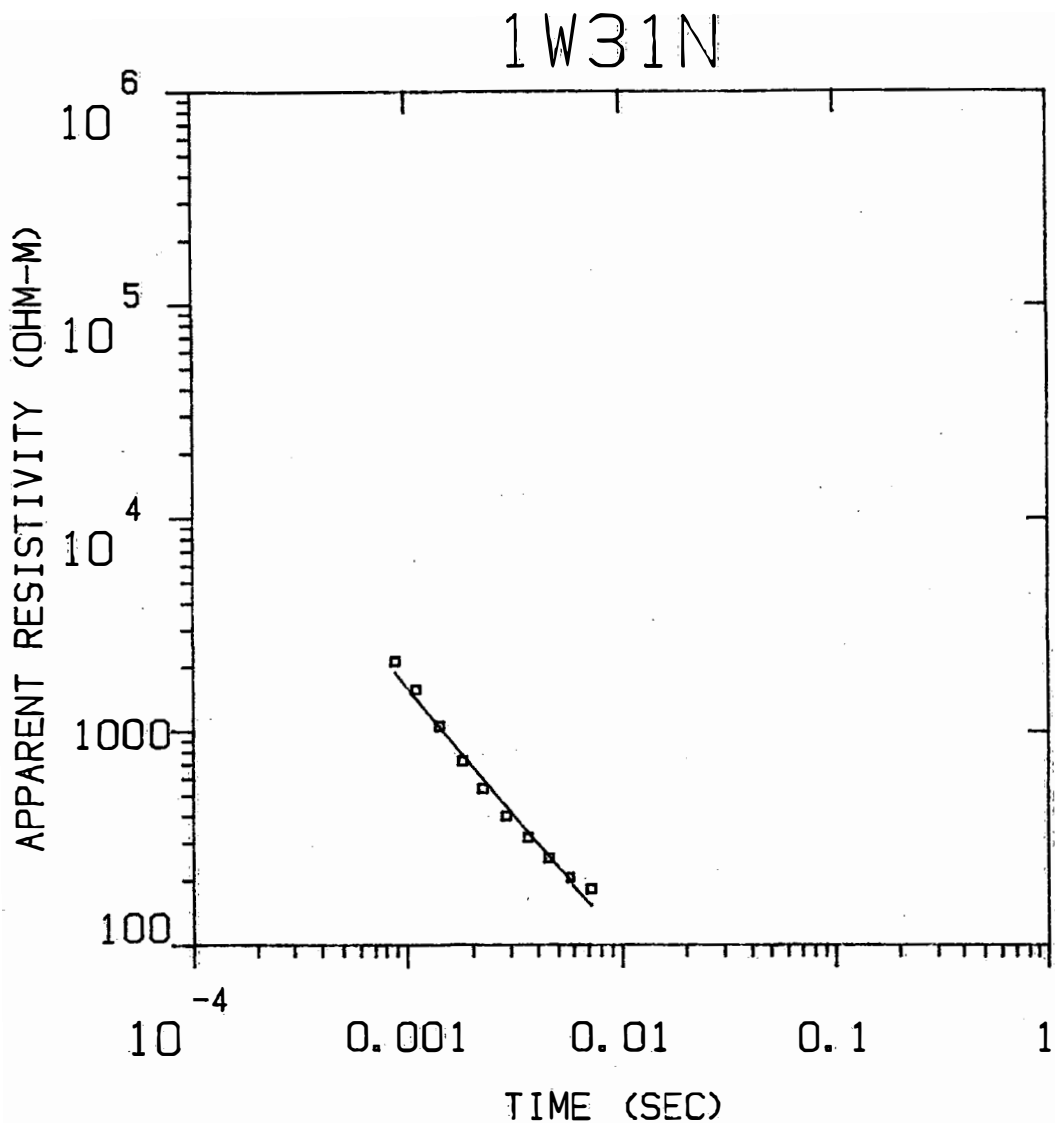
P 2 -0.04 0.94

F 3 0.00 0.00 0.00

T 1 0.01 0.01 0.00 1.00

T 2 -0.01 -0.03 0.00 0.00 0.94

P 1 P 2 F 3 T 1 T 2



MODEL:

2709.  
OHM-M

659. M

2.80  
OHM-M

% ERROR: 15.0  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 170.0  
INTERPEX: ARRTI

1W31N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
2708.79	659.3	487.7	1600.0		
2.80		-171.6	-563.0	0.2	0.2

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.81E-04	2.13E+03	1.88E+03	13.216	
2	1.10E-03	1.56E+03	1.43E+03	9.074	
3	1.41E-03	1.05E+03	1.04E+03	0.192	
4	1.80E-03	7.25E+02	7.79E+02	-7.023	
5	2.22E-03	5.37E+02	5.99E+02	-10.370	
6	2.05E-03	4.00E+02	4.46E+02	-10.303	
7	3.60E-03	3.16E+02	3.38E+02	-6.365	
8	4.49E-03	2.54E+02	2.61E+02	-2.614	
9	5.70E-03	2.06E+02	1.99E+02	3.342	
10	7.19E-03	1.81E+02	1.53E+02	18.548	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 10 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: 1W31N  
SOUNDING 31

RMS LOG ERROR: 6.08E-02, ANTILOG YIELDS 15.0287 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.12

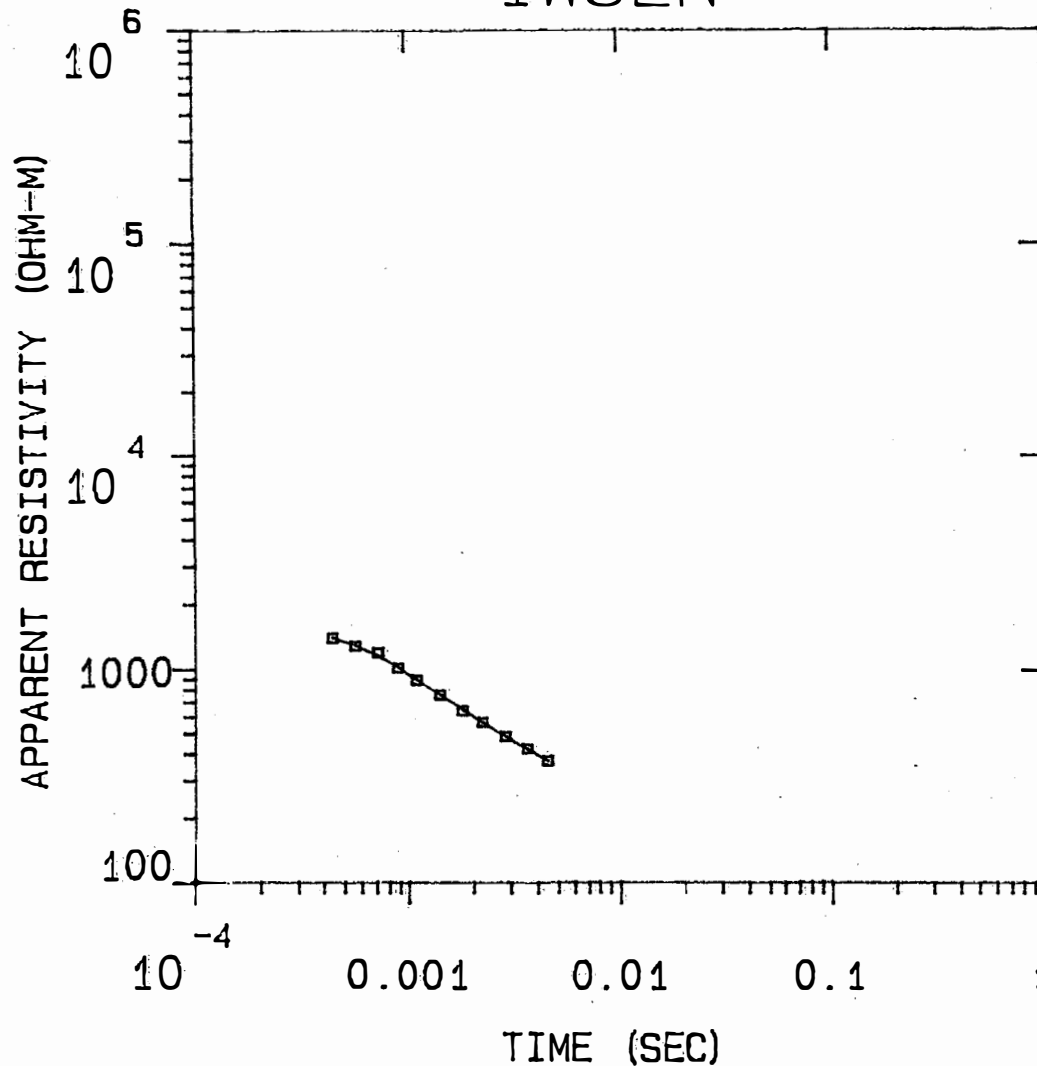
F 2 0.00 0.00

T 1 0.01 0.00 1.00

P 1 F 2 T 1

1W32N

MODEL:



906.  
OHM-M

711. M

98.6  
OHM-M

% ERROR: 1.82  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 210.0  
INTERPEX: ARRTI

1W32N

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
905.55	710.9	597.4	1960.0	0.8	0.8
98.60		-113.5	-372.4		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	1.40E+03	1.42E+03	-0.938	
2	5.64E-04	1.29E+03	1.29E+03	-0.560	
3	7.13E-04	1.20E+03	1.16E+03	3.361	
4	8.81E-04	1.02E+03	1.03E+03	-1.021	
5	1.10E-03	8.96E+02	8.99E+02	-0.354	
6	1.41E-03	7.61E+02	7.62E+02	-0.068	
7	1.80E-03	6.40E+02	6.49E+02	-1.453	
8	2.22E-03	5.66E+02	5.65E+02	0.181	
9	2.85E-03	4.86E+02	4.84E+02	0.285	
10	3.60E-03	4.24E+02	4.22E+02	0.518	
11	4.49E-03	3.73E+02	3.73E+02	-0.034	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 11 DATA POINTS, RAMP: 210.0 MICROSEC, DATA: 1W32N  
SOUNDING 32

RMS LOG ERROR: 7.82E-03, ANTILOG YIELDS 1.8161 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

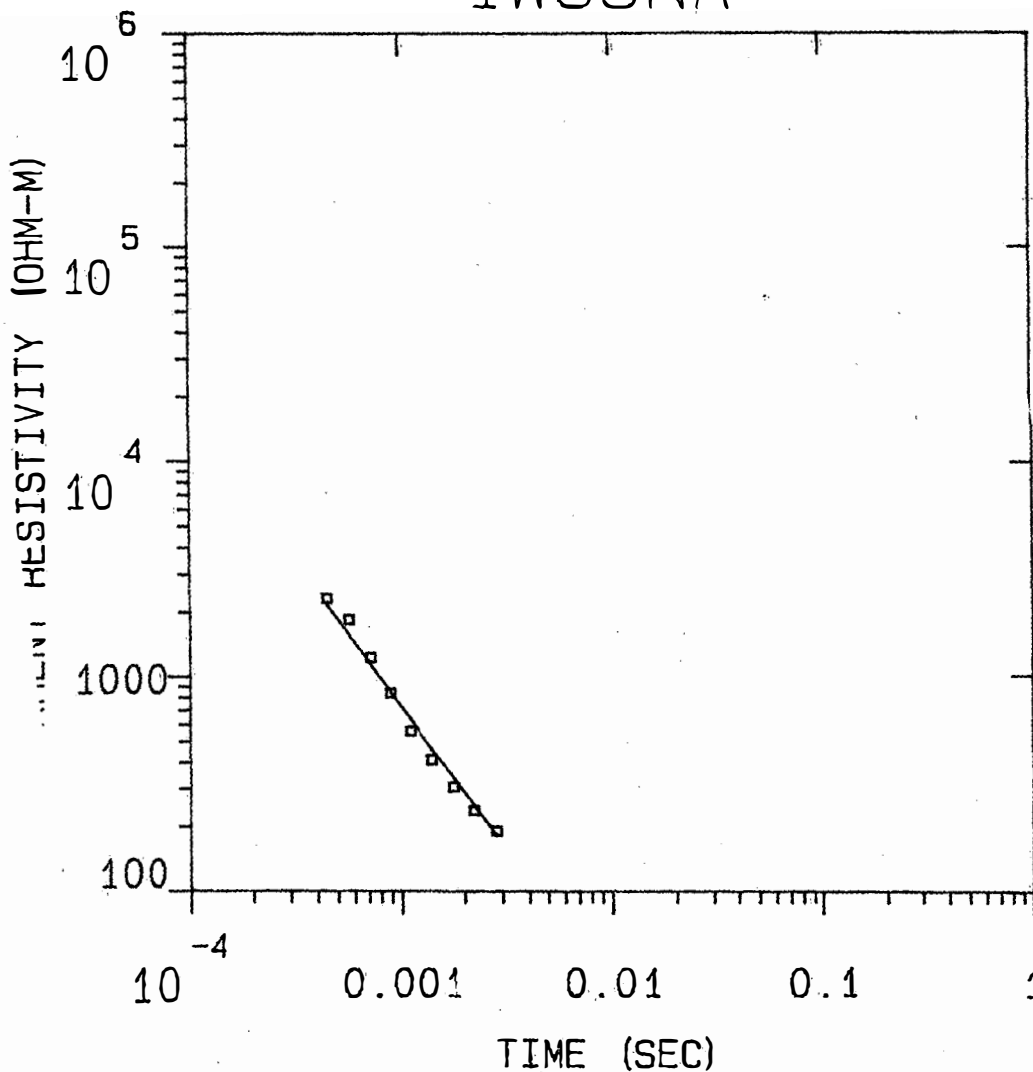
PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

1W33NA

MODEL:



42088.  
OHM-M

501. M

2.80  
OHM-M

% ERROR: 15.5  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 160.0  
INTERPEX: AARTI

1W33NA

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
42088.40	501.3	378.0	1240.0		
2.80		-123.4	-404.8	0.0	0.0

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	2.31E+03	2.17E+03	6.780	
2	5.64E-04	1.85E+03	1.56E+03	18.492	
3	7.13E-04	1.23E+03	1.13E+03	8.879	
4	8.85E-04	8.38E+02	8.42E+02	-0.498	
5	1.10E-03	5.55E+02	6.30E+02	-11.888	
6	1.40E-03	4.09E+02	4.56E+02	-10.439	
7	1.77E-03	3.04E+02	3.34E+02	-9.129	
8	2.20E-03	2.36E+02	2.49E+02	-5.136	
9	2.80E-03	1.89E+02	1.80E+02	5.368	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
1000 FOOT LOOP  
1000 FOOT LOOP  
RMS LOG ERROR: 6.26E-02, ANTILOG YIELDS 15.5147 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

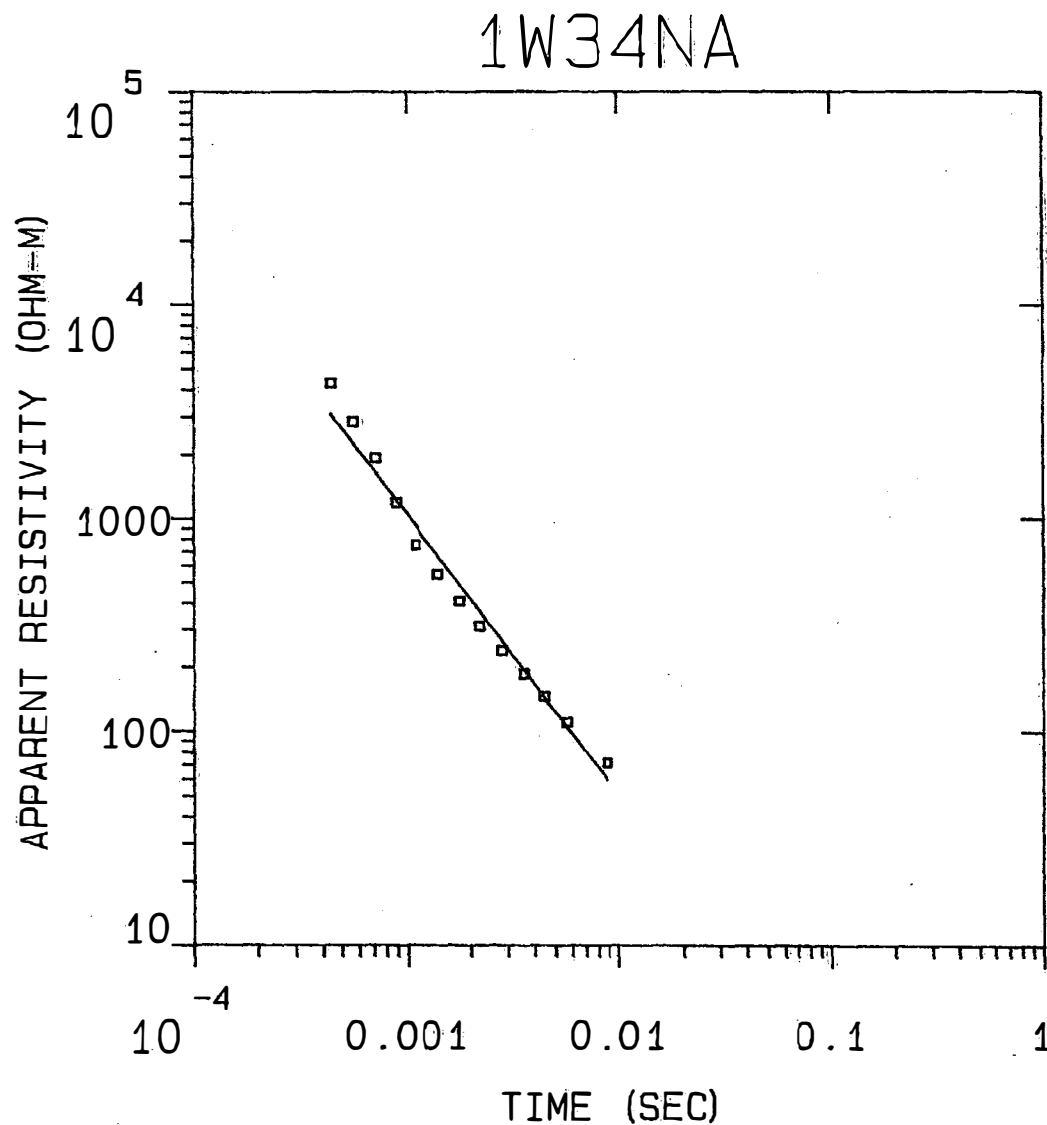
"F" MEANS FIXED PARAMETER

P 1 0.00

F 2 0.00 0.00

T 1 0.00 0.00 0.98

P 1 F 2 T 1



MODEL:

28594.  
OHM-M

574. M

2.80  
OHM-M

% ERROR: 28.5  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 160.0  
INTERPEX: ARTTI



1W34NA

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
28594.42	574.2	411.5	1350.0		
2.80		-162.7	-533.7	0.0	0.0

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	4.26E+03	3.09E+03	37.890	
2	5.64E-04	2.85E+03	2.23E+03	27.864	
3	7.13E-04	1.93E+03	1.63E+03	18.491	
4	8.85E-04	1.19E+03	1.22E+03	-2.505	
5	1.10E-03	7.49E+02	7.08E+02	-17.450	
6	1.40E-03	5.46E+02	6.57E+02	-16.973	
7	1.77E-03	4.07E+02	4.82E+02	-15.655	
8	2.20E-03	3.12E+02	3.62E+02	-13.720	
9	2.80E-03	2.39E+02	2.63E+02	-9.254	
10	3.55E-03	1.86E+02	1.92E+02	-3.084	
11	4.43E-03	1.46E+02	1.42E+02	2.275	
12	5.64E-03	1.10E+02	1.04E+02	5.478	
13	8.81E-03	7.16E+01	5.93E+01	20.703	

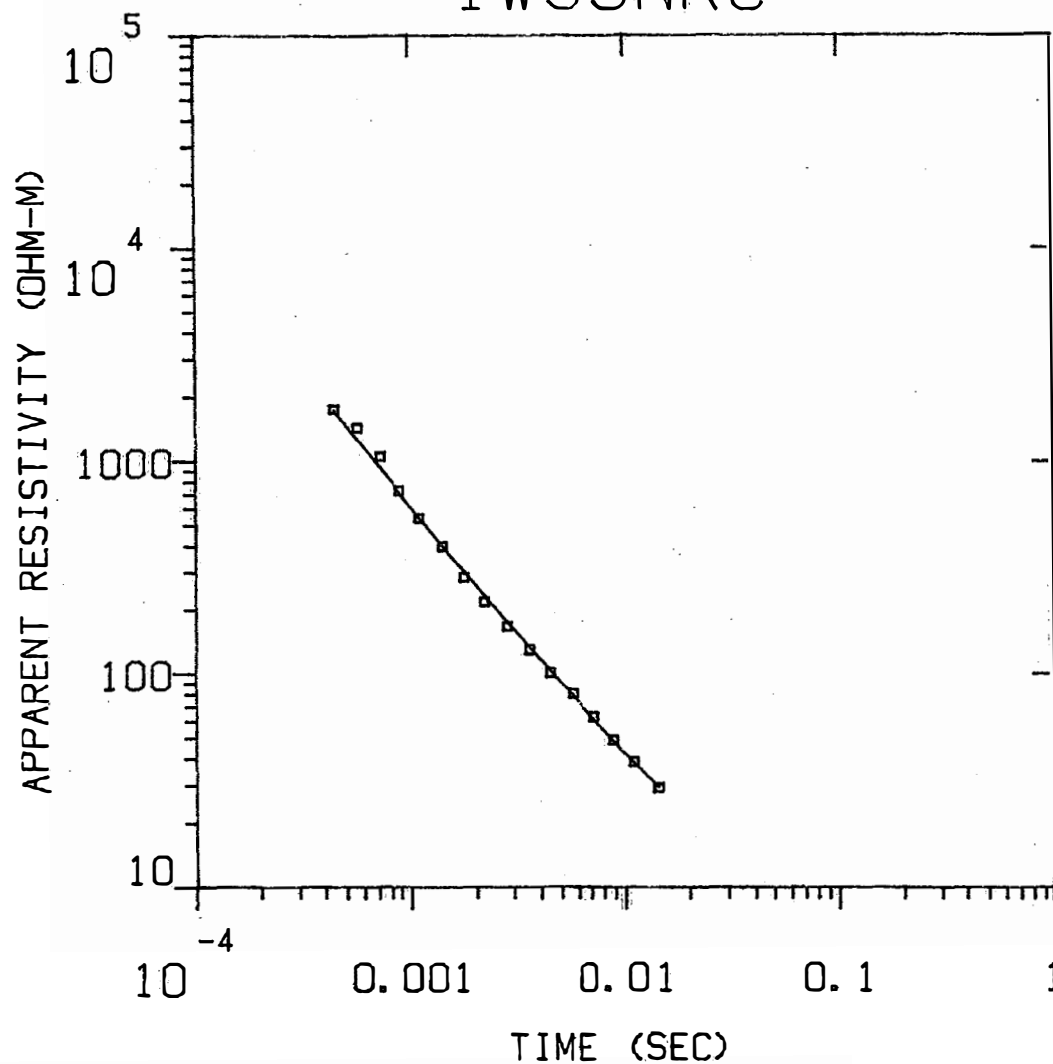
R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 13 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: 1W34NA  
WAIKOLOA  
1000 FOOT LOOP  
RMS LOG ERROR: 1.09E-01, ANTILOG YIELDS 28.5474 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:  
"F" MEANS FIXED PARAMETER  
P 1 0.34  
F 2 0.00 0.00  
T 1 -0.14 0.00 0.95  
P 1 F 2 T 1

1W35NRC

MODEL:



12038.  
OHM-M

438. M

2.80  
OHM-M

% ERROR: 8.18  
CALIBRATION: 1  
OFFSET: 152. M  
RAMP: 170.0  
INTERPEX: ARRTI

1W35NRC

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
12038.08	437.7	378.0	1240.0	0.0	0.0
2.80		-59.8	-196.1		

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	1.74E+03	1.73E+03	0.419	
2	5.64E-04	1.42E+03	1.27E+03	12.307	
3	7.13E-04	1.05E+03	9.38E+02	11.593	
4	8.85E-04	7.23E+02	7.12E+02	1.582	
5	1.10E-03	5.38E+02	5.45E+02	-1.251	
6	1.41E-03	3.97E+02	4.02E+02	-1.332	
7	1.77E-03	2.83E+02	3.04E+02	-7.007	
8	2.20E-03	2.17E+02	2.35E+02	-7.494	
9	2.80E-03	1.66E+02	1.76E+02	-5.592	
10	3.55E-03	1.29E+02	1.34E+02	-3.436	
11	4.43E-03	1.00E+02	1.04E+02	-3.541	
12	5.64E-03	8.04E+01	7.94E+01	1.275	
13	7.13E-03	6.25E+01	6.13E+01	1.969	
14	8.81E-03	4.88E+01	4.85E+01	0.625	
15	1.10E-02	3.84E+01	3.82E+01	0.542	
16	1.41E-02	2.92E+01	2.93E+01	-0.518	

R: 152. X: 0. Y: 152. DL: 305. REQ: 169. CF: 1.0000  
TDHZ ARRAY, 16 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: 1W35NRC  
WAIKALOA RANCH  
1000 FOOT LOOP RECALC  
RMS LOG ERROR: 3.41E-02, ANTILOG YIELDS 8.1761 %  
LATE TIME PARAMETERS

\* BLACKHAWK GEOSCIENCES, INC. \*

PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1 0.00

F 2 0.00 0.00

T 1 0.00 0.00 0.98

P 1 F 2 T 1